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FIRST SESSION—THIRTIETH PARLIAMENT  
1974-76

THE SENATE OF CANADA  
PROCEEDINGS OF THE  
SPECIAL COMMITTEE OF THE SENATE ON  
**SCIENCE POLICY**

The Honourable MAURICE LAMONTAGNE, P.C., *Chairman*

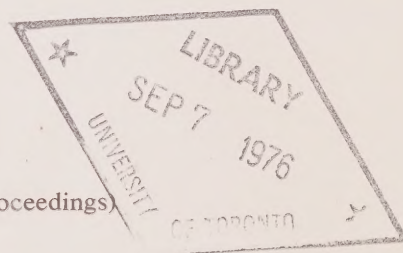
Issue No. 17

WEDNESDAY, AUGUST 11, 1976

Seventeen Proceedings on

The Study of Canadian Government and  
other expenditures on scientific activities  
and matters related thereto.

(Witnesses and appendix: See Minutes of Proceedings)





THE SPECIAL COMMITTEE OF THE  
SENATE ON SCIENCE POLICY

The Honourable Maurice Lamontagne, P.C., *Chairman*

The Honourable Donald Cameron, *Deputy Chairman*

and

The Honourable Senators:

Asselin	Hastings
Bélisle	Hicks
Bell	Lang
Blois	Manning
Bonnell	Neiman
Bourget	Riel
Buckwold	Robichaud
Carter	Rowe
Giguère	Stanbury
Godfrey	Thompson
Goldenberg	van Roggen
Grosart	Yuzyk
Haig	

27 Members

(Quorum 5)

# Order of Reference

Extract from the First Report of the Special Committee of the Senate on Science Policy, presented on July 10, 1975 and printed as an Appendix to the Minutes of the Proceedings of the Senate of that day, and adopted by the Senate on July 24, 1975:

"The Committee, therefore, recommends that it be authorized to consider and report on Canadian government and other expenditures on scientific activities and matters related thereto;

That the Committee have power to engage the services of such counsel and clerical personnel as may be necessary for the purpose of the inquiry;

That the Committee have power to send for persons, papers and records, to sit during adjournments of the Senate and to report from time to time; and

That the Committee be authorized to print such papers and evidence from day to day as may be ordered by the Committee."

Robert Fortier,  
*Clerk of the Senate.*



# Minutes of Proceedings

Wednesday, August 11, 1976

(27)

Pursuant to adjournment and notice the Special Committee of the Senate on Science Policy met this day at 9:33 a.m., the Chairman, The Honourable Senator Lamontagne, presiding.

*Present:* The Honourable Senators Bell, Bourget, Buckwold, Godfrey, Lamontagne, Lang, Stanbury and Yuzyk. (8)

*Present but not of the Committee:* The Honourable Senator Lafond. (1)

*In attendance:* Mr. Philip J. Pocock, Director of Research, and Jacques Ostiguy, Chief of Administration.

The Committee resumed consideration its Order of Reference dated July 24, 1975 relating to the study of Canadian Government and other expenditures on scientific activities and matters related thereto.

The following witnesses from Atomic Energy of Canada Limited were heard:

Dr. J.S. Foster, President;

Dr. A. M. Aikin, Vice-President,  
Administration and Planning;

Dr. A. J. Mooradian, Vice-President,  
Chalk River Nuclear Laboratories.

On Motion by the Honourable Senator Yuzyk, it was *Agreed* that the preface and appendices one to thirteen of the brief presented to the Committee by Atomic Energy of Canada be printed as an appendix to this day's Minutes of Proceeding and Evidence. (*See Appendix No. "31"*)

Mr. Foster made a preliminary statement. The witnesses then answered questions put to them by Members of the Committee.

At 12:40 p.m. the Committee adjourned until 2:30 p.m., Wednesday, August 11, 1976.

ATTEST:

Patrick Savoie,  
*Clerk of the Committee.*

# The Special Committee of the Senate on Science Policy

## Evidence

Ottawa, Wednesday, August 11, 1976

The Special Committee of the Senate on Science Policy met this day at 9.33 a.m. to consider Canadian government and other expenditures on scientific activities and matters relating thereto.

**Senator Maurice Lamontagne** (*Chairman*) in the Chair.

**The Chairman:** Honourable senators, we have with us this morning representatives of Atomic Energy of Canada Limited. We have Dr. J. S. Foster, who is President of this crown corporation; Dr. A. M. Aikin, Vice-President, Administration and Planning; and Dr. A. J. Mooradian, Vice-President, Chalk River Nuclear Laboratories. I do not want to make any further introduction of these gentlemen, whom most of you know.

At this stage I should like to propose that we print as an appendix to today's proceeding from the submission received from Atomic Energy of Canada Limited, which is only the 1975 addendum, the part of that addendum up to and including Appendix 13, because I understand that most of the other appendices are available elsewhere, and they are rather bulky, except for your statement, Dr. Foster, which I am sure has been made available to others as well, so it is not considered as an original presentation at this stage.

**Dr. J. S. Foster, President, Atomic Energy of Canada Limited:** No.

**The Chairman:** Is that agreeable, honourable senators?

**Senator Yuzyk:** I will make that motion.

**Senator Bourget:** I second it.

**The Chairman:** Is it agreed?

**Hon. Senators:** Agreed.

**The Chairman:** Mr. Foster, would you make an opening statement, just to start our operations this morning?

**Dr. Foster:** Mr. Chairman, and honourable senators, I do not have a formal statement, but I would like to make a few remarks. We are, of course, very pleased to have this opportunity to appear before the committee, and we are looking forward to the discussion this morning.

I might elaborate a little on our background so that you know a little more about who is here. Ara Mooradian is Vice-President in charge of the Chalk River Nuclear Laboratories, and formerly was in charge of the Whiteshell Nuclear Research Establishment, so he has got experience across that total breadth of our research and development part of the organization. Archie Aikin, who is now Vice-President, Administration and Planning, was also at one time head of Whiteshell, and at another time head of our commercial products organization, so he has a breadth of

knowledge of the company. I have spent nearly all my time with the company in the last 20 years in the nuclear engineering part of the organization, and for several years as head of the power projects organization in Toronto; that is the breadth of my experience.

The interest of the committee is, of course, science, and ACL does a great deal of scientific research, but our activities extend beyond that, and I thought I might say a word about our role before we continue.

**The Chairman:** We claim to extend beyond that too.

**Mr. Foster:** Yes, I am sure. Our role, as we see it, is to develop nuclear energy in various aspects to the point where it can be useful for Canada. That means doing research, development and demonstration. For instance, in nuclear power plants themselves we carry the development through to the point of having three demonstration plants, NPD, Douglas Point and Gentilly. At this stage we are no longer involved in building nuclear power plants for ourselves; they are developed to the state where utilities can build them themselves without assistance or involvement from us, except in the engineering sense, so we have gotten to the point where the nuclear power plants are now available.

The next stage that seemed important to Canada a few years ago was that Canada should get into nuclear power plant exports. There is only one organization in Canada really to play in this game, and that is Canada, so it required an agency of the government to open up this field of nuclear exports for Canada because of the big technological and financial resources that clients look for in anybody whom they want to supply nuclear power plants.

The next area that has been necessary to get going is the production of the essential material for these reactors. In our case it is heavy water, and AECL has gotten involved in the production of heavy water. As you know, the first attempts at heavy water production were to do it on a commercial basis, but it is scarcely of normal commercial interest, because there is such a small market, namely the utilities. In fact, one of the major utilities, Ontario Hydro, has gotten into the business itself, so the market is relatively small and uncertain, and it is new, so we are in the heavy water business to get it launched.

The next phase of development that we see, where it is necessary for us to carry the development through to the point where it is an available option for the country, is the development of a more efficient cycle for power reactors. We have an excellent system in the natural uranium CANDU system, and an ideal one for the initial years of a program. By the initial years I mean at least the first quarter of a century, because it requires relatively small capital investment, outside the power plants themselves, in that heavy water plants are small compared to diffusion plants, for instance. It was, therefore, a very good system



to launch, as I say, the first quarter century of development.

Beyond that there is the possibility that there may be a limit on the uranium resources and more efficient methods will be required, so the next stage, as we see it, is to develop the more efficient cycles, including the thorium fuel cycle, and getting that to the point where twenty years or so from now people will at least have that as a realistic option if the availability or the cost of uranium, the cost of the enrichment and the cost of other things related to the fuel cycle are such that there will be the option of going to the thorium cycle.

The other line we are working on beyond that is electro-nuclear breeding; that is, using an accelerator to convert fertile material to fissile material. That is a longer range development, but we see that as the line following along from the more efficient direct fission cycle. Again we are using some of the experience gained in doing the development towards that to create a more efficient and very flexible therapy accelerator, which we think will have a very important place in that field. We are now developing that for introduction in the next couple of years.

I think, Mr. Chairman, that is a summary of our role as we see it.

**The Chairman:** Thank you very much, Dr. Foster. Before I ask Senator Bourget to lead the questioning, I should like to put one question myself as background. Could you describe to us the new responsibility of Mr. Campbell as chairman of the board? This is a new position. Before that I understand Dr. Gray was both chairman and president.

**Dr. Foster:** Mr. Campbell is chairman of the board.

**The Chairman:** Is he full-time?

**Dr. Foster:** He is full-time chairman of the board. I am president and chief executive officer of the company. Mr. Campbell's responsibilities are concerned with all the functions of the board and its responsibilities. Our shareholder is the government, apart from the qualifying shares for the directors. The board, of course, reports to the shareholders, so that is one of Mr. Ross Campbell's main functions, reporting to the minister. I believe many of the senators present know Ross Campbell and his long experience with the Department of External Affairs. Consequently he is very well equipped to deal with our international relations, of which we have many. So he takes a particular interest in that aspect of our relations. He tends to concentrate on the external relations of the company, that is relations with the government and Ottawa and with other countries.

**The Chairman:** Thank you very much, Dr. Foster.

**Senator Bourget:** Thank you, Dr. Foster, for your remarks, also for your very interesting brief, which is not really brief.

My first question relates to the fact that I understand that the main objective of AECL has been, and still is, to get Canadian utilities in a position at which they can produce low-cost energy in a clean and safe manner. Can you tell us what improvements and progress have been made in the CANDU system with respect to its cost and safety aspects since your organization last appeared before this committee?

**Dr. Foster:** As you know, since the sessions in 1968 the most important development has been the operation of the Pickering station. With respect to experience, that plant cost \$375 per kilowatt in those days. The Bruce Generating Station, which consists of four 750 megawatt plants, will cost coming in today, five years later, about \$600 per kilowatt. Put on comparable terms that is, as I recall the last time we looked at that, approximately 10 per cent less than Pickering in dollars per kilowatt, based on dollars of the same year. We have difficulty, of course, in making comparisons between various plants. However, there is no doubt that the increased capacity of the units, going up from 500 megawatts to 750 megawatts and Ontario Hydro then going on to 850 megawatt units, has an effect in improving the economies, not only of the capital cost of the plant, but with respect to the operating staff cost, because it does not take proportionately that many more personnel to operate the bigger units.

**The Chairman:** Before you go to the safety aspects, Dr. Foster, could you make comparisons with other sources of electrical energy?

**Senator Bourget:** That was to be my next question. I wonder if you have made any study with respect to the cost per kilowatt hour produced by your system in comparison with the kilowatt hour cost for other systems, particularly with respect to hydro power.

**Dr. Foster:** Yes, we have done that. Probably the best comparisons are those that have to be made by Ontario Hydro, for two reasons. One is for determining what their program should be. Secondly, you may remember that we and the Province of Ontario have an investment in the first two units at Pickering and the payback of the parties in that is based on the relative economy of operating that plant compared to their Lambton station. Pickering consists of four 500 megawatt units and Lambton is four 500 megawatt units, both built at approximately the same time, the units at Lambton being fired with coal. The current cost of the energy from Pickering is approximately half that from Lambton. I will have to speak from memory, but today the energy from Pickering would cost approximately 11 mills per kilowatt hour and that from Lambton would cost closer to 20 mills. So there is a prospect of a very favourable payback to the other parties.

**Senator Buckwold:** What was the difference in the capital cost of the two plants?

**Dr. Foster:** Pickering was \$375 per kilowatt and I believe Lambton cost \$140 per kilowatt, so there was a big difference in the capital cost. However, the big saving is in the fuel cost, with at Pickering is a little over one mill per kilowatt hour, maybe 1.1 or 1.3 today, and that for Lambton is between 10 and 15 mills per kilowatt hour.

**Senator Buckwold:** So, in a relatively short period the difference in the capital cost will be equalized?

**Dr. Foster:** Yes.

**Senator Bourget:** When Dr. Gray appeared before this committee in 1968 he said that there was no nuclear power station in the world that had yet proven itself and it will not be proven for 25 years. However, he was confident that it would operate for 25 or 30 years. What is the situation in this regard today?

**Dr. Foster:** There are plants in the world now that have been operating since the end of the 1950s. The first British

station started up in 1956 and the first American station in 1957. Those stations are still operating, so there is approximately 20 years of experience with the first nuclear power stations in the world.

In this country, NPD started up in 1962, so we have approximately 14 years of operating experience and there is every indication that these plants will last at least their predicted 30-year life. There may come a point, particularly in the case of a plant such as NPD, which is relatively small, at which it would become relatively uneconomic to operate it, just because of its size. However, for a station such as Pickering there is every reason to expect that it will fulfill its life expectation.

**Senator Bourget:** But you cannot be sure of that, because this has some effect, also, on the cost of energy produced by nuclear power.

**Dr. Foster:** Yes, life of the plant is very important out of 20 years; it diminishes beyond that in the energy calculations, but I think what Dr. Gray meant when he mentioned 25 years is that we cannot count our chickens before they are hatched. However, there is every reason to expect that the plants will last their full 30 years.

**The Chairman:** Senator Bourget, I believe in your first question you mentioned the safety aspects and the witness did not have the opportunity to deal with that important point.

**Senator Bourget:** Yes, that is true.

**Dr. Foster:** With respect to safety, of course, these plants have always operated safely and the experience in the rest of the world is similar. That is, there have been no instances in which nuclear power plants have injured people through radiation. In fact, in other respects Ontario Hydro keep very detailed records of lost man-hours due to accidents in plants and the nuclear plants are safer than the thermal plants on their system. In addition, they know that it is safer for their employees to be in the station than at home because the work practices in the stations are better than those at home.

**The Chairman:** With their wives?

**Dr. Foster:** I have not investigated the causes of these accidents. So the stations have been very safe and improvements in safety, which I think was your question, senator, are changes that have been made in the plants with a view to ensuring this safety even more. There have been evolutions of the design as a result of the analyses and dealings with the Atomic Energy Control Board that have made these plants even safer than they were originally. Although the earlier plants were completely safe, in our opinion, extra systems have now been added, compounding that degree of safety, such as a second shut-down system, for instance, on the latest reactors.

**Senator Bourget:** Dealing with the safety aspect, Dr. Foster, I should like to quote briefly from an article which appeared in the *New York Times* of July 18, reproduced in the *Gazette* of last Monday. I know you are aware of the article, but I should like to quote from it for the benefit of members of the committee. I think it is a very interesting article, particularly as it relates to the CANDU system. The article reads, in part, as follows:

In hopes of lessening the risk that nuclear electric-power reactors might help other countries make atomic weapons, the Arms Control and Disarmament

Agency is examining a new approach to the recycling of spent uranium fuel rods.

A little further on, it states:

The new idea is to recycle the spent fuel directly to a different type of reactor, a natural uranium reactor...

For that reason, it could relate to the CANDU system.

Would you care to comment on that article, Dr. Foster?

**Dr. Foster:** The basis for that is that the fuel that is discharged from a light water reactor after it is no longer sufficiently reactive to be used in a light water reactor is still sufficiently reactive to constitute a good fuel in the CANDU, or heavy water reactor. In fact, it is a little better than natural uranium for this purpose.

There are different possibilities that one could consider. The fuel could be taken directly from a light water reactor and used in a heavy water reactor. This would involve a whole new design of heavy water reactors and really would not be a very practical arrangement. Another possibility would be to disassemble the fuel and reassemble it in another form. The fuel in light water reactors is a bundle, usually a square bundle, of rods, about three-eighths of an inch in diameter. It takes about 60 of these rods to make a square bundle nine feet tall. Those squares could be disassembled and the rods reassembled in round bundles to fit the pressure tubes. Again, that is not a very practical possibility.

It is possible that one could reprocess the fuel and not separate the plutonium from the uranium. The concern from the arms control point of view is having the plutonium separated. One could then reconstitute a fuel starting from that mix of material from that fuel processing plant.

Even after you have irradiated it in a CANDU reactor and it comes out the other end, there is still a very valuable energy resource in the form of the plutonium left in the spent fuel. Unless some new energy system, such as fusion or further exploitation of solar energy makes fission reactors unnecessary, it makes sense to use that plutonium. So, that idea puts off the consideration, but does not eliminate it.

Is there anything you wish to add, Dr. Mooradian?

**Dr. A. J. Mooradian, Vice-President, Chalk River Nuclear Laboratories, Atomic Energy of Canada Limited:** I think you have covered it, Dr. Foster. Certainly, it is possible to process the fuel and simply separate the fission products from the plutonium and the uranium and reconstitute the fuel from that point. I certainly agree with Dr. Foster that it would require a major convulsion in the design of the fuel and the reactor to allow the fuel to be taken from the light water reactor and put directly into a heavy water reactor.

**The Chairman:** If that process were to become practical, would it eliminate the danger of having increasing quantities of plutonium available in the world at large?

**Dr. Foster:** No, I do not think so, Mr. Chairman. It would not eliminate having large quantities of plutonium mixed in fuel. Beyond that, it would not eliminate the separation of plutonium because of the fact that plutonium is a very useful energy source and is particularly valuable, for example, in the fast breeder reactor. I think the world will want plutonium available for this kind of purpose.

Plutonium is not as easy or as attractive a material to divert for malevolent purposes as is generally believed. I



think the object should be to control the operations making use of plutonium to guard against that diversion rather than trying to avoid the use of plutonium.

**The Chairman:** How would such safeguards be formulated?

**Dr. Foster:** We feel that the reprocessing of the fuel which separates the plutonium from the rest of the fuel should be closely associated with the reconstitution of that plutonium into fuel material and the refabrication of fuel. In this way, we feel that the inventories of preconcentrated plutonium can be kept very small. In other words, as soon as it appears in the process, it is diluted with uranium or thorium, whichever is the case, to go on to the next stage. So that the amount of the concentrated plutonium that is available is kept small and the area in which it is available is kept small; that is, these two facilities would be, say, back-to-back on the same site.

That is the type of measure that we think makes it practical to guard the plutonium at that point. However, as I indicated earlier, for malevolent purposes, plutonium is not all that easy or that attractive to use.

**Senator Buckwold:** Dr. Foster, I think we are now dealing with one of the most important aspects of this discussion. We are counting on nuclear energy to solve our future energy needs.

I spent two weeks at Habitat where the question of a moratorium on the extension of nuclear power plants was raised. Such a moratorium was endorsed by all of the intellectuals present, including many of the world's top scientists. The general view was that plutonium is a dangerous by-product. I gather it is the irradiation of uranium which produces the plutonium. It was felt that it is something over which we have no control and that a bomb the size of a grapefruit could blow up the world. I was a witness to some of the hysteria that was created at some of the discussions, especially in the Habitat Forum. It was frightening.

One of the leaders of the group, a gentleman of whom I am sure you are aware, to show how easily it was to obtain plutonium, indicated that he himself had been offered, from some clandestine group, plutonium on the black market. That plutonium, of course, would be available to terrorists, or anyone else. This gentleman literally swore that what he said was true. Of course, that created great hysteria among members of the group.

I think we should really try, in some depth right now, to take a look at this. You perhaps have said very—I wouldn't want to say "glibly", because that isn't your description but you passed on rather lightly the fact that this wasn't as dangerous as people make it out to be—it was controllable; and yet there are many people in the world who disagree. I think I would like to have a little more in-depth discussion of that, perhaps some reaction, because he must have come back to you on this offer of plutonium to be sold on an under-the-counter deal to whoever wanted to buy it.

**Dr. Foster:** Well, on that offer, I don't know much more than was in the press at the time. I believe the police were investigating it, and they certainly should, and I have not heard any conclusion of the investigation. As far as I know, he was not able or he was unwilling to substantiate the bald statement. I think if he really had a concern he had a responsibility to divulge his source to the police; and, anyway, that kind of thing should certainly be traced very assiduously; and I do not know more than that on that fact.

Now the dangers of plutonium that are talked about are diversion for terrorist purposes as an explosive or as a poison. As an explosive the claim is made that it is very simple to take plutonium and convert it into a bomb, and this just is not so. In the first place, it is not found in very convenient forms, starting with the fuel element. That would be an impossible task, to steal fuel elements with the resources that would be available to terrorist gangs, to start from that point. Because of the fission product activity and the necessity for large flasks to carry the thing with any impunity; apart from picking up the reprocessing at that point and carrying it on to the production of a bomb all clandestinely.

The next stage is the chemical solutions, and here at the right point there is little less radiation activity but the chemical solutions are a very difficult thing to deal with too. But let us assume that they have somehow gotten the solutions. Converting that, extracting the plutonium and then converting that material into an explosive is not a simple task, even if you know the design of the explosive. It requires a good deal of scientific input and mechanical skill to produce these things—not the kind of thing that a terrorist group is likely to have.

**The Chairman:** Isn't it true Dr. Lewis once wrote that any country could do that with time and text books?

**Dr. Foster:** Yes, that is true. Any country could produce nuclear weapons. I was referring to the diversion for terrorist purposes.

**The Chairman:** There are countries—

**Dr. Foster:** Any country that has the resources and has the intention—

**Senator Buckwold:** I don't think you have to differentiate.

**Dr. Foster:** Well, that is a different thing. An organization with the resources of a nation, with the determination to produce weapons, can do so. That is, a country of some stature.

**Senator Lang:** Like India?

**Dr. Foster:** Not any country but many countries. So that is quite true, but that is another matter. On the toxicity question, this might be a good time to turn it over to Dr. Mooradian because we could all answer if we would like to.

**Senator Buckwold:** I think toxicity was probably the major concern and that is the fact that plutonium, I don't know, will create a radiation problem for 500,000 years or something—I have forgotten.

**Senator Bourget:** Right.

**Senator Buckwold:** Or some ridiculous number of years. You can't get rid of it. Perhaps you could tell us a little more, and what do you do with the plutonium that you are now developing?

**Dr. Foster:** Well, we would be glad to.

**Dr. Mooradian:** Well, I would just like to add one other point to Dr. Foster's point on the reactors themselves. If one's sole purpose is to make plutonium, it is very much cheaper and very much easier to make it without making power plants. The major expenditures and skills required in the power plants take you out in the steam generating parts of the system. One needs to be able to boil water so

the temperatures have to be high. One needs special alloys, and so on, so if one is bent on making plutonium for purposes other than power, certainly a power plant is the last way you would select to do it, by quite a large margin, by a factor of two to three in costs. Technically it is very much easier to make reactors that use water that is not boiling.

To get to the question of waste management that you are talking about, what is the problem with the radioactivity that comes out of the reactor? What is the size of the problem? Is it an economic problem? Is it a technical problem? Or is it some other problem? We have done many studies on the size problem, for example, and if we did nothing with our spent fuel but simply store it in perpetuity—that is to set up funds for perpetual maintenance—its economic impact on the cost of power would be something less than 2 per cent. The wastes are so compact in ashes that one can afford to even think in terms of buying land at a million dollars an acre and still make a trivial impact on the cost. So we do not see that as an economic problem.

Technically many of us have been working on this for many years at Chalk River, and we have one experiment which has been going on for 15 years where we have taken the waste, incorporated them into glass and buried them in a basin, completely controlled, above the water table to get the most severe conditions. We have been monitoring this on an annual basis over that period of 15 years. That was technology that we had 15 years ago, and this looks very good. The elusion from these glass blocks that we have buried under these very poor conditions is so old that we could consider a major program of installation even within the small area we are talking about at Chalk River for waste management.

But nature can do very much better than that. A few thousandths of an inch of mica, for example, we know can prevent radioactivity from diffusing out of a solid for a billion years. Technically, it is highly likely, from a technological point of view, that when one chooses to sequester them from the biosphere it can be done. We do not see an economic problem there.

The public acceptance problem is a different one entirely. I would like to distinguish here between two hazards; one is the hazard of the fission product. When uranium is split one gets two particles, and the fission products are relatively short lived. That is to say that within 600 years the radioactivity will die back.

**The Chairman:** That is long enough for me.

**Dr. Mooradian:** But we have many man-made structures that have stood for that long. We have cathedrals and buildings of that kind that have stood for over 600 years. So it is credible to engineer structures to last for 600 years and after 600 years the radioactivity of all these things will have died back to about the original radioactivity of the uranium of which there is a great deal in the earth's crust.

As for plutonium and other related so-called actinides the problem is different. The half life of plutonium is about 24,000 years, so essentially plutonium has to be considered a poison in perpetuity. There are many other poisons that are elemental in nature that man has had to live with for a very long time and among them are the more common ones such as mercury, lead, arsenic, selenium, beryllium and a couple of others that are highly toxic to man if they get into man's system. So the idea that a poison in a poison in perpetuity is not a new idea for man to have to cope with, but the size of the problem is what to do with the plutoni-

um and the actinides, aside from the fact that one now knows that the spent fuel bays are essentially an energy mine. At the moment we go out and we scour the country to find uranium, and the question we ask ourselves is, "How much uranium can we find?" Now the uranium that we find produces just about the same amount of energy as we can get from the plutonium, knowing where it is, that is to say that if we separate the plutonium from the uranium after the fuel is spent and simply recycle that back in the simplest cycle we can find we can extract from it in the Candu system almost the same amount of energy as we could from the original uranium.

**Senator Buckwold:** Does that mean that that goes on in perpetuity?

**Dr. Mooradian:** Yes, you can take the product that results from that and recycle it again.

**Senator Buckwold:** And does plutonium create more plutonium?

**Dr. Mooradian:** Yes. It does so by creating neutrons which are then picked up by the uranium which transforms it into plutonium.

Now a great deal has been made about the toxicity of plutonium and some statements have been made that it is the most toxic material known to man. Well, I separated the first plutonium or I was party to the first separation of plutonium at Chalk River back some 20 years ago and of all of my colleagues that were with me in that enterprise none of us has been poisoned by plutonium. Bob Hart who lives out at Whiteshell was part of that scheme and we have a few others in Chalk River. We were aware of the sort of hazard that plutonium generated at that time. Let me give you some examples. On the question of toxicity one has to consider two aspects. If one takes uranium orally 10 grams is required on average to produce on the best calculations we have at the moment one cancer death, and that is apt to happen some 30 years after it was first ingested. Now for comparison I have just picked out four common poisons and for potassium cyanide it is 0.7 grams, lead arsenic 0.1 gram, seleniumoxide, which is used in solar receptors, it is 0.3 grams and mercuric chloride is 0.8 grams. All of those are a full order of magnitude more than plutonium ingested.

The real problem and the greatest hazard is in dispersing plutonium and breathing it into the lungs and there the toxicity is significantly higher. If it is inhaled it takes about 1.4 milligrams and that is two orders of magnitude less, but that has to be compared with nerve gases and stuff called benzopyrene which is the active ingredient in tobacco and they are more toxic than plutonium. When one considers the problem, you can take an ounce of plutonium and if you are able to actually disperse it, so that each person gets 1.4 milligrams, you can do a lot of damage with plutonium. However, it is very difficult to put into a smoke and have the smoke remain in the air and then be sure somebody is there to breathe it at the time it happens to be in suspension.

**Senator Buckwold:** What about the radiation problem?

**Dr. Mooradian:** For plutonium it happens to be alpha-active. By that I mean that most of the radioactivity that comes from plutonium is in high energy but short-range particles. A piece of paper, for example, would do a great deal to cut down the radiation level that would come from a small amount of plutonium; or your skin would. How-



ever, there is a gamma-active component, which is like X-ray, which is harder, but that component is very much less, to the extent that when we set up the plutonium separation line we just had plastic shields on the line. There is some gamma activity, but not sufficient to be hazardous.

**Senator Yuzyk:** How thick is the plastic?

**Dr. Mooradian:** About a quarter of an inch, half an inch.

**Senator Buckwold:** Before we pass from this, Mr. Chairman, I should like to add one thing, because this is very important to me. What do you do at Pickering, for example, with your waste? Are you recycling it?

**Dr. Mooradian:** No, we are not. I did not mention the three sorts of storage options available for what we would call interim storage. The fuel from all our reactors, and indeed all the reactors in the world, comes out of the reactor and goes into a water-filled bay, a pool storage system as it is called. The plan in Canada is to hold the fuel in such bays for about ten years and follow this by either processing it, if the country chooses to go that route, or putting it into more passive or interim storage bays. We have three concepts that have been investigated for that. One is a large pool storage concept. Another is a concrete canister concept, two full-scale prototypes of which are now in operation at Whiteshell. This is essentially a six-foot concrete cylinder that stands 16 feet high; in it there is a hole to put the spent fuel in, and the spent fuel can be sealed into that. The third concept is a more concentrated convective storage. The last two are both passive; that is, somebody does not have to stand around and be sure the water is clean, or something of that sort. Those would be designed for at least about a 50-year life.

**Senator Lang:** Why don't you circle it around now? If you can get all that energy now, why not keep it going around in a circle?

**Dr. Foster:** First, we have to do the development to develop the process for doing this. Then there is the economics of scale; that is, you have to have a big enough program to justify the expenditure in reprocessing and fuel refabrication plant to pay for itself. Those two things coincide, as far as we can see, about twenty years from now; that is, it will probably be economic by about that time, and we can do the development work in that time.

**Senator Lang:** Would it take you that long to do the development work?

**Dr. Foster:** Yes.

**Dr. A. M. Aikin, Vice-President, Administration and Planning, Atomic Energy of Canada Limited:** To the demonstration.

**Dr. Foster:** Yes. If it is commercially attractive at that time it will be available to go ahead on a commercial basis.

**Senator Lang:** Is that a significant component of your present R&D work?

**Dr. Foster:** Not yet. We are doing some work on it. I think altogether about \$4 million of our budget is spent on things related to it; that is, the preliminary analytical work, engineering studies and so on with respect to fuel reprocessing. There is a pilot fuel production plant for experimenting with the production of fuel incorporating

plutonium. At the present time runs have been done with uranium, but plutonium has not yet been run, I think.

**Dr. Mooradian:** Not yet.

**Dr. Foster:** It is at the preliminary stage.

**Senator Stanbury:** My question is related to the article that was mentioned earlier and the matter of cost. Perhaps I think it comes back to what you were just saying, whether the cost of developing the system, the recycling system, described in the article is in the long time worth while, particularly if some of the other governments in the world, who are most concerned about reassurance, and even the public reassurance that might come from following this kind of system, decide to go ahead with it. Is it worth our while to be in a position to take advantage industrially of that process? We seem to have the jump on the others, because the CANDU system seems to be particularly well equipped to handle this kind of recycling process. My concern is whether we are in a position to keep our advantage and to use this new departure, if it does develop as a practical alternative.

**Dr. Foster:** Yes, very much so. There are two things here, though. The article to which Senator Bourget referred was concerned with taking fuel from a light water reactor and putting it through a heavy water reactor, and that is a questionable matter; that might be done at some time.

**The Chairman:** Can you assure us that you are looking very seriously at this, even if you foresee some difficulties?

**Dr. Foster:** Yes, I think we are going to get a formal question from the United States to look at this.

**Dr. Aikin:** They have indicated it.

**Dr. Foster:** If we get such a question we will certainly look at it seriously.

**The Chairman:** Could you look at it on your own initiative?

**Dr. Foster:** It is not an entirely new idea; it was thought of some time ago. It is new and original, I believe, with the Arms Control Development Agency in the United States. However, in other discussions with the United States Atomic Energy Commission in the past this had been thought about. As I say, it has some merit, but I think the more important thing will be to think about reprocessing our own fuel.

In reply to Senator Stanbury, I think it is very important that we do this, because the CANDU reactor is the best reactor for using the thorium cycle. Other countries, that are hedging against possible shortage of uranium in the next century, are developing fast breeder reactors. All those reactors depend on uranium, and for a while they are not going to help the uranium situation; maybe at 20 or 25, or something like that, they begin to. There is going to be more pressure on uranium. So that it behooves us to have a thorium cycle available, which considerably reduces our uranium requirements and enables us to go out into another resource, thorium. To kick off a thorium cycle some other fissile material, as it is known, such as plutonium, is needed in the fuel that we are radiating now. So the whole thing fits in and we think it will be very important to have that in place before the end of the century. Therefore it is a real option for the country.



**Senator Yuzyk:** We do not have any fast breeder reactors in the country at all, do we?

**Dr. Foster:** No, sir—

**Senator Lang:** No one does; there is no such animal yet.

**Dr. Foster:** —and we are not carrying on any development.

**Senator Lang:** How far away does it look? Every time I have heard an answer it becomes further away.

**Dr. Foster:** Yes, we can say where they are. The French have a 250 megawatt unit operating, which is a fast reactor; it is hardly a fast breeder, in that it just about produces as much fuel as it uses, or as much plutonium as it uses, so it goes along at a constant level. It works very well, but it is conservative in that respect, that it is not a real breeder and it is conservative in the design of some of its equipment, notably its heat exchangers and so on. Therefore it is not really a prototype. Europe is going ahead, based on that, to produce a 1,000 megawatt unit. So I believe fast breeders are a prospect for 1995, or the end of the century, depending on their success. The French are the furthest along, but they have had about two years' difficulty with it. They are getting it going now and we hope that it will keep going. The Russians have had one of about the same size going and have also had difficulties. They had a sodium fire at one point. The Americans are putting a lot more money into development. They are not so advanced in the production of a proto unit, which will be a few years off. They are only at the front end of building one, as a matter of fact, so it is 7 or 8 years away before they get to the same state of demonstration. However, they have done a lot more development work, so if they run into problems they may be in a better position to work their way out. As you say, the time is moving back on it.

**Mr. Chairman,** may I say one thing about the deposit of spent fuel and the wastes from the fuel, because there is one aspect which I do not believe we concluded. We had mentioned the fission products decaying away in five or six centuries, but we did not mention the eventual fate of the plutonium in those wastes. By the way, I should say that we are thinking in the same terms as the rest of the world, of taking these glasses and burying them in a deep, stable geological formation. All indications are that this could be safely buried in the topsoil, but that is just one more safety measure and, as Dr. Mooradian said, it does not cost very much relative to the cost of the energy. So we are sure that we can build something like that which will be good for five, six or more centuries if we compare it with some of the things that man has built in the past, which were much more difficult than this type of mine. But then what happens to the plutonium? We could say that the toxicity of that material relative to the toxicity of the material that originally came out of the mine, the toxicity in the ore from which this plutonium was derived, would be about ten times as much. We are not discussing a big factor and, in fact, if we do the reprocessing we are talking perhaps three times. In fact, it is possible to have it about the same level as the toxicity of the material in the original ore. So we are putting it back about where it was. Although I know people point out that it lasts a long time, the level we are talking about is very low.

**Senator Godfrey:** Mr. Chairman, my question refers also to waste. I would like you to put some kind of handle on the physical volume, for example at Pickering, where you

store this waste in the cement structure. How much space would be needed for that in 50 years?

**Dr. Foster:** The spent fuel storage bay at Pickering, which was designed to look after those four reactors for ten years, is about—I am doing it from recollection now and the appearance of it—30 feet wide by less than 100 feet long. However, I have another number. Between now and the end of the century in Canada it is predicted that nuclear power will produce as much electrical energy as was consumed in Canada during the last decade. So, taking that amount of electrical energy, the spent fuel from that could be stored in storage bays which are typically 25 feet deep. The fuel is stored in the bottom 12 feet, because the top 13 feet is clear water for shielding. With such a pool, 25 feet deep and the waste on the bottom 12 feet, it would take an area approximately the size of a football field to store all the fuel that would produce the equivalent of the energy consumed in Canada during the last ten years.

**Senator Buckwold:** My home is in Saskatchewan, where the Uranium City Eldorado mine is located, which now causes some very real concerns as to the effect it will have on the community insofar as radiation and other possible effects are concerned. I presume that this is a matter of concern, but is the fact that even taking uranium out of the ground could have possible effects on those who live in the area worrying AECL? Certainly there is a very real reaction in that community.

**Dr. Foster:** This particular situation is beyond our detailed knowledge, because it is, as you mentioned, an Eldorado property and we do not become involved in it in any way. The Atomic Energy Control Board, of course, as the regulatory agency does. However, from our general position, that is interest in nuclear energy in general, we are interested in all phases of it, including the mining. We would like to see everything done throughout the whole program in a very safe and clean manner. Part of that is certainly proper management of the spoil from these mines, the mine tailings. We must acknowledge that in some places in the past these have not been looked after as well as they might have been. As I say, I cannot refer to any particular situation, but we are concerned that the organizations dealing with it do it in a very safe and proper manner, certainly from here on.

**The Chairman:** Are you a member of the Atomic Energy Control Board?

**Dr. Foster:** No, I am not, sir.

**The Chairman:** Your predecessor was.

**Dr. Foster:** Yes, until a few years ago; he was not at the end of his appointment.

**The Chairman:** Before you proceed to the other subject, Senator Bourget, I would like to make a more or less final comment with respect to safety. I heard Dr. Mooradian mention all the care and measures that you are taking to ensure safety, and I am sure that this is done. However, he then referred to the dialogue and the growing opposition on the part of the public. I do not believe that the discussion at the moment in the world is exclusively between the producers of nuclear energy and the public. There are many respected scientists and engineers who are not as sure as you as to the safety aspects of nuclear energy. I recall, for instance, a statement made by Dr. Alvin Weinberg, a great authority in this field, to the effect that the

worldwide construction of nuclear plants will require a technological priesthood.

Personally, I would not want to rely on a technological priesthood. I am not all that convinced that we will have such a priesthood. It seems to me that the dialogue between the optimists and the pessimists at the scientific and engineering levels should continue so that the public can be assured of the safety aspects.

**Dr. Mooradian:** I am not in any way suggesting that one should cease being concerned. One is continuously generating information. I think it is a very healthy situation to have the technology question at all levels. I would be very disappointed if, as a result of canvassing members of my laboratory, you came up with a consistent view on any given question. I ask my people to be original thinkers.

One does go to the asymptote of truth in this, as one does even in the political arena. I have met Dr. Weinberg subsequent to his making that statement, and a discovery has been made since the making of that statement. Prior to this it was thought that radioactivity or reactors were a completely original invention of man. As it turns out, approximately one billion years ago there was a concentration of uranium in Gabon that reacted spontaneously. It is now thought that there are probably other spontaneous reactors that have been produced by nature. I am not completely conversant with that technology, but Dr. Weinberg viewed this as an extremely important event, both philosophically and technologically—philosophically in that man was not the originator of fission energy and technologically because the plutonium found in these deposits resulting from that reaction have indeed been found to be well sequestered and shielded from the biosphere for a period in the order of one billion years.

**The Chairman:** Dr. Weinberg, of course, was not the only one. I do not think I need pursue this further. I have made my point.

**Senator Godfrey:** I think it is a very valid point, Mr. Chairman. I am wondering how many other scientists are of the view of Dr. Weinberg.

**The Chairman:** There was also Dr. Lovens

**Dr. Foster:** Those two individuals are in quite different categories. Dr. Weinberg has been in the business from year one. He knows the business very well and has expressed this kind of concern. Basically, he is not greatly concerned about the safety of nuclear power or going ahead with nuclear power. He simply points out that there are some difficulties inherent in it that have to be handled properly. Dr. Weinberg made the analogy of a priesthood being required. That does not seem to me to be the best analogy. I think a better analogy is the operation of the airlines. Air flight is a business that has grown to be a very large international business with many units operating. The safety record in fact improves with the development of larger aircraft and better methods. So, it is possible to have international organizations capable of managing these new technologies safely.

**The Chairman:** Do you think that the Atomic Energy Control Board should do more to inform the public about the dialogue which is going on in the world?

**Dr. Foster:** That is a difficult question, Mr. Chairman.

**The Chairman:** It is part of its mission.

**Dr. Foster:** Yes. The role of the Atomic Energy Control Board is one of regulation; that is, to keep the rest of us in line. Certainly, it should inform the public as to what is taking place. However, if it devotes too much of its efforts to that aspect of it, it begins to take on the role of promotion of the business, which might jeopardize its position. It has been set up as an impartial judge of what is being carried out by the people building and operating these plants.

**The Chairman:** But as part of its impartial responsibility it could gather information on both sides of a given issue and sort out the valid allegations from those that have no validity, thereby putting the various points of view before the public.

**Senator Lang:** The public is seeking some such authority. Your evidence is obviously self-serving as far as the public is concerned, so what you say will not count. The public is looking for some authority, such as the Atomic Energy Control Board, to which it can turn for an impartial reaction to these concerns.

**Dr. Foster:** It is a difficult matter, and I realize how difficult it is for the public, who cannot be informed on the detail from us and others in the business and then opposite statements from our critics. They do not have any datum on which to base the validity of these various statements; they do not have anything to relate these statements to. I can understand the desire for having a very clear, impartial referee. There is no easy solution. There is no one who we can readily suggest should be that referee.

I think the Atomic Energy Control Board could do something in that direction, Mr. Chairman, but there is a limit as to how far it can go.

**The Chairman:** It could at least act as a clearinghouse to segregate the bad literature or arguments from the good ones.

**Senator Stanbury:** A very good example of that, Mr. Chairman, is a statement which was made at the Habitat Conference to the effect that one ounce of plutonium, strapped to a piece of dynamite and exploded could cause the evacuation of a city the size of Vancouver for perhaps 100 years. According to the evidence of Dr. Mooradian, that would seem to be a bald-faced lie. Yet it is printed and distributed, and no one with Dr. Mooradian's credibility has come out and said it is a lie.

**Dr. Foster:** We are now getting into the area of explosions, and so forth. There have been 10 tons of plutonium released into the atmosphere.

**The Chairman:** Senator Godfrey.

**Senator Godfrey:** Mr. Chairman, I do not feel satisfied in my own mind that I got an answer to my question. What is the conventional thinking in this regard? Are these just a bunch of lunatic fringe people, or is there a great body of highly scientific, well qualified people who disagree with you? Is it just a few people? Just give us some kind of a handle so I can say, "Look, they are not a bunch of kooks."

**Dr. Foster:** No. A whole range of people have concern about nuclear power and about many other things. You have mentioned scientists, and so on, who are very qualified people. Almost all of them, as far as I know, are scientists who do not have direct experience with nuclear power. According to the press, one PhD is as good as another, or one Nobel laureate is equal to another, but they



are in different spheres. You could count on the fingers of one hand those scientists who have a real familiarity with nuclear power and have expressed concern. Dr. Aikin might wish to comment here.

**Dr. Aikin:** Yes. As Dr. Foster said, there is a whole spectrum of people, and no doubt some of them are kooks and are looking for a campaign or something to be against. That group should not be ignored, but they can be handled. However, there are very serious-minded people, very intelligent people, who are looking at this whole question of nuclear power and they are concerned about the production of radioactivity and saying that we are increasing the amount of radioactivity in the world.

The honourable senator mentioned the Habitat Conference. One of the most prominent speakers at that conference was Barbara Ward, who came out very strongly against nuclear power. I have heard Barbara Ward speak. She says that the world had to wait three billion years for radioactivity to disappear before life could start, and that now we are bringing it back again. There are other people like her. They are eloquent speakers and they are very sincere, but what they do not know is that radioactivity has been present in the world since the beginning of time. It is still here. There is a tremendous amount just from natural causes. So, people such as this have not really evaluated the problem; they do not have the background to do so.

There is that type of person. Then there are others, such as Dr. Lovens, to whom the chairman referred, who believe that if we continue making technological advancements, society will become too complex, that if society has to depend on an electrical power system for all its energy needs it will be subject to interruptions and failures. They believe that life would become too hazardous and they would be subject to whoever happened to control the switches at the power plants. They are saying that this is not socially acceptable to them. They want to have a system of energy generation whereby it will be in much smaller units, and the individual will have control over his energy supply rather than leaving it to a very large system.

This is a social question which is quite separate from the hazards, if they do exist, associated with nuclear power. But these things get mixed up, and those who are what we might call antitechnocrats, pick on something like nuclear power. This is not unique. There are other technologies that they pick on, but nuclear power represents one of the zeniths of technology. If you are trying to put a stop to the growth of technology and the growth of society in that direction, then go after nuclear power. There are very intelligent people writing books and doing studies on this, and I think society needs to be looking at their arguments to decide whether what we are saying is right or not and whether we may be going too far in some of these things.

As I see it, there is a real mix up here between technical and social arguments, and I think some of this came out at Habitat and it has come out elsewhere. We think we have the technical answers. We do not think that we are endangering mankind by going ahead with nuclear power, but as to the broader aspects of how society is going to react to growing technology over the next 25 years in something that is well beyond scientists alone to say.

**The Chairman:** Well time marches on, unfortunately.

**Senator Bourget:** Is any international organization looking into the aspects of this problem?

**Dr. Foster:** Which aspects? There are many international organizations, Senator Bourget. There is International Atomic Energy Agency, of course, which is a daughter, by the way, of the UN. The International Energy Agency is another one. OECD has an NEA group. There are many co-operative arrangements.

I attended a meeting in Denver, Colorado, about a month ago in which it was decided that all the industrialized countries should co-operate in the field of waste disposal and the preparation of residues from the fuel cycle for waste disposal. An *ad hoc* committee has been organized from eight or nine of the industrialized countries to make sure that we pool our knowledge in this area and perhaps to do joint development. So there is a lot of international co-operation in this.

**Senator Bourget:** But there is no permanent organization?

**Dr. Foster:** For what aspect?

**Senator Bourget:** For the safety aspect.

**The Chairman:** And evaluation.

**Senator Bourget:** An organization where people can get some guidance on this.

**Dr. Foster:** Well, the International Atomic Energy Agency is one that has taken a particular interest in safety.

**Dr. Aikin:** The International Atomic Energy Agency has done some very active work in this area over the years and they are attempting to set minimum international safety standards as guidelines to all nations, and this is designed particularly for developing countries getting into nuclear power to give them some guidance as to what safety standards they should insist upon. This is a permanent organization studying this, and under the International Energy Agency there is a permanent sub-committee of the R&D section dealing with safety, nuclear safety and radioactive waste disposal.

**The Chairman:** But would that agency be more or less in the same potential conflict of interest situation that you are in?

**Dr. Aikin:** That may well be because they are interested in seeing to it that the members of the IEA have sources of energy.

**Dr. Mooradian:** There is one other international agency that has been in existence for a very long time. It was instituted after the introduction of X-ray technology. This agency is completely impartial in that it draws its membership from the scientific community associated with genetics, radiation biology and so on. It reads the entire literature produced in the world on this question on what are safe limits and what are the consequences of increased radiation. They set their standards. It is called the International Commission on Radiological Protection, and it is independently funded as well. It sets the standards which all countries use as the maximum standard for the public's exposure, and I think our own control board uses the standards of the International Commission on Radiological Protection in setting the criteria for the operation and safety of Canadian plants.

**The Chairman:** As you know, the Atomic Energy Control Board was not on our list of agencies that we expected to hear, but the committee may decide later that we should



hear them, perhaps later in the fall, because there is a great deal of interest in this aspect of the matter, and since this is the Canadian agency which has that mission we might decide to hear them later.

**Senator Bourget:** Another objective you had in the past was to offer an economic plant for the export market. May I ask what kind of results you have had so far with respect to the sale of the CANDU system and what are the prospects for the future?

**Dr. Foster:** As you probably know we sold a plant in 1973—the contract went into effect in April, 1974—to Argentina and another to Korea which went into effect in January of this year. So those were the two sales that were effected of two 600-megawatt plants. Then there were the earlier sales to India and by Canadian General Electric to Pakistan. In addition we are negotiating a licensing agreement with Italy for the construction of CANDU type reactors in that country. We have negotiations going on with Romania. Of course the countries who have already bought CANDU reactors would like to continue with the CANDU program and obtain more CANDU reactors. That is to say that Korea and Argentina would like to have had two units rather than one. But there are no active negotiations going on with respect to those. It depends on the availability of financing and other things. But the interest is there.

We are also having preliminary discussions with Mexico. They have two light water reactors under construction but they are interested in having a CANDU reactor program too.

**Dr. Aikin:** The whole question of export is something we are again having very seriously reviewed interdepartmentally. There has been, as you know, a lot of criticism and questions have been raised about the export of CANDU plants to countries around the world, and we have certain guidelines that we work out together with the Department of External Affairs. We certainly clear with them before we show any active interest in any particular country. But basically our marketing has been a response type marketing, that is to say we do not send people out trying to sell the CANDU reactor; we have only responded to expressions of interest on the part of other countries who would like us to talk to them about the possibilities of providing CANDU reactors. So because we have only a response type of operation we only have at the moment two people actively involved in a marketing program, and one of these deals part time with other things as well.

**Senator Bourget:** This kind of marketing is about the same as existed when your organization appeared before our committee in 1968. At that time also you only had two men. Have you improved your marketing system since then?

**Dr. Aikin:** We have improved our marketing system. We have doubled our staff. We had two then and we still have two, but if you count the president and myself then we have four, and we have learned a lot on how to go about this. We are supported to a considerable extent by the engineering organization in Toronto which prepares the technical proposals, and then the drafting of contracts and so on which is done here in Ottawa. So in effect I should say that there is a back-up staff that adds many more to the two people actually doing the marketing work. But we have not—and I think I should emphasize this—pushed this perhaps to the extent that many people believe that we

have. We have not gone out pounding doors around the world.

**Dr. Foster:** Perhaps I should add that there is a limit to what we should be doing here anyway; that is, we do not, as a country, want to bite off more than we can chew. The program in construction of nuclear power plants in Canada through the 'sixties and early 'seventies was about one unit a year. Then in 1973 the Ontario Hydro program expanded. In addition, two other provinces, Quebec and New Brunswick, got into the field. In the early 'eighties—which means we are doing the engineering and manufacturing for it now—our domestic program will step up to three or four units a year. In addition, we have sold these two units overseas, so that makes it perhaps four or five a year, stepping up from one or two.

**Senator Bourget:** So you are limited.

**Dr. Foster:** There is a limit.

**Senator Bourget:** Depending on the size of the plant.

**Dr. Foster:** There is a limit to how rapidly we can expend, depending on the engineering capability, the manufacturing capability, heavy water production capability, and the scope of financing available and so on. All these things put a limit on it. We cannot be too aggressive at the sales end and not be able to follow through with producing the plants.

**Senator Lang:** Is foreign interest confined to the Pickering type CANDU or does it extend to the Gentilly type CANDU?

**Dr. Foster:** Just to the Pickering type. This is because it is a demonstrated system in commercial sizes, whereas the Gentilly plant is an experimental unit to test a new alternative.

**Senator Bourget:** That was the purpose of the Gentilly plant, just as an experimental basis?

**Dr. Foster:** Yes, to test the idea of using ordinary water as a coolant instead of heavy water, and using it in the direct cycle; that is, steam going directly to the turbine.

**Senator Bourget:** So there would be no commercial interest in purchasing the Gentilly reactor?

**Dr. Foster:** Not until there are commercial applications of it. We see possible commercial applications some years away in connection with the thorium cycle or a cycle in which there is fuel recycle.

**Senator Stanbury:** I am a little disturbed because of the philosophy involved here in connection with the aggressiveness of selling. If we have a principle against selling the equipment, I understand that, but I gather that the principle on which we have been operating is that we are interested in selling. What you have been telling us reminds me of what of former Minister of Industry, Trade and Commerce told me at one time when I was complaining about Canadian businessmen not being out in the world. He said, "You know, Dick, we don't export. We permit others to import from us." I think that is generally the attitude of Canadian businessmen.

Here is a program into which we have ploughed multi-millions of dollars in research and effort, of people like yourselves and many others, but then we are not equipped to go out into the world and sell it and get the advantage of it. What is the basic problem there? Is it because Canadian

industry has not responded to the opportunities? Is it because you have not done something that you should have done? Or is it because there are political decisions that have been involved that have prevented it? Why would we spend all this money and effort over all this time to develop a great technology, which we say is leading in its particular field in the world, and then not be prepared to go out and sell it aggressively in the world?

**Dr. Foster:** The reason for the development, of course, was for our domestic requirements. That was the basic thing. The country is employing it as it needs it. Ontario Hydro is applying nuclear power at the rate it wants to in its system. Other things are determining the rate at which its system is expanding, but at least within that it is applying nuclear power to the extent it wants to. In Quebec, our Gentilly-I unit is down there; they have bought their first one, which is building now, which will gradually bring them into the nuclear field in a big way after their hydraulic resources are gone, or developed as far as they want to, in the late, eighties. The Maritimes are now getting into nuclear power; it is the natural future energy resource for them, and they are getting in at a good time. There is no inhibition on the part of any of these utilities against applying nuclear power; there is no problem there.

When we think of expanding into the overseas market, domestic growth is putting quite a load on all facets of the business and we are adding to that with these two units already in Argentina and Korea. There will be other units following that. However, there is a rate at which we can sensibly expand and have capable people to do all these jobs. The engineering gets stretched; deliveries of equipment are late, although I am not saying the manufacturers are not meeting the demand, but they are stretched, they are working hard to do it. There is a limit to the rate at which we can do this; there is a limit to how much we can add on top. That is the only thing.

**Senator Lang:** What sort of agreement is the Italian agreement? You say there is a limit on your capacity. I presume there is no limit on the ability to license.

**Dr. Foster:** Even with respect to the ability to license, it means transferring information in a way that they can use it. Let us take the Italian agreement as an example. There is a licence agreement for which we will receive royalties, and we provide them with information which enables them to design and build plants. They cannot just take that information and do the job. On the first job there is also an engineering consultancy agreement that will involve us in a very material way; not as much as if we were to do an export job ourselves, but very nearly the same as if we were doing the engineering for one of our own export jobs, and in certain technical areas just as much. There is the same kind of limit.

**Senator Lang:** The supply problem is theirs, not yours?

**Dr. Foster:** That is right. They supply the equipment. But even then, some of the equipment for the first units must come from Canada. In a licence arrangement that is not so demanding on Canadian industry.

**Senator Lang:** I have a very strong impression, perhaps incorrectly, that the requirements we are imposing on purchasers of nuclear machinery from us are an inhibiting factor in any event in the foreign operations of AECL. Would you like to comment on that?

**Dr. Foster:** You mean the safeguards requirements?

**Senator Lang:** Yes.

**Dr. Foster:** Some of the safeguards requirements are difficult for a recipient country, because this infringes on their sovereignty. However, all the supplier countries are working together to establish a consistent set of requirements. I think you find the same thing in reading accounts from the United States; it is pointed out that this is inhibiting their sales because their requirements are so restrictive. I think in that sense it washes out.

**Senator Lang:** Except for France.

**Dr. Foster:** No. To be fair to France, I think France has come a long way towards co-operating with other nations in this suppliers' group. In my opinion today there is a much more consistent relationship among all the industrialized nations in selling in the world than there was two, three or four years ago.

**Senator Godfrey:** How do you price these international sales and domestic sales? Do you amortize the research and development? Do you make money, or lose money? On what basis do you charge Ontario Hydro, for instance, for all the work you have done throughout the years? Somehow we must have a proper bottom line to the balance sheet.

**The Chairman:** And how much will we lose on the work with Argentina?

**Dr. Foster:** Any real major profit at the bottom is a long way off because, as I say, our job is in the promotional end, to get it going. However, let us take, for instance, the work we do for Ontario Hydro. There we act as an engineering consultant; we charge them our costs, plus a percentage which covers our overhead expenses, plus a certain amount, which has been 15 per cent of the cost of our engineers, draftsmen and other people directly concerned in the work, which we use to defray the cost of development to some extent.

Other things we do in working for Ontario Hydro include some development work, for which they pay directly. There are some programs, such as prototype testing, for instance, with a new fueling machine design. We are testing that equipment, though to go on an Ontario Hydro job. We charge them, or whoever it may be, if it is the first benefiting project, 25 per cent of the cost. We then hope to recover the remainder of it on later projects. So some of the costs are picked up in that manner. For any testing done just as a service because of our facilities, we charge them.

When we come to export work, it is a different matter, because it is not a cost-plus-a-fee type of operation, but a firm price. By a "firm price" we mean that there is a base price. We put a lump sum on a certain scope of supply, with an escalation formula for which Statistics Canada indices are used as a basis. How we do on that project depends on how good our estimate is and then how good our performance is after we have got the job. Again, our interest is not just—this is the dichotomy, or the ambivalent position in which AECL must be. We are the agent of the government in addition to being a commercial organization in this business and we cannot think as can an ordinary commercial company. That is, we put more stress on Canadian content, at some sacrifice to our balance sheet. That is a little more in that direction than in the



case of a normal commercial company. So that affects the type of results we produce.

**The Chairman:** Delays in reaching agreements and inflation would, perhaps, be other elements?

**Dr. Foster:** Yes, sir.

**The Chairman:** How much would you lose on the Argentina deal?

**Dr. Foster:** We are not in a position to give a number yet. We have a pretty good estimate of that today, but we are at the stage with the client, the Nuclear Energy Commission of Argentina, at which we have agreed in principle and are now writing the amending agreement in detail to cover the effects of this inflation. I should say that Argentina has been very co-operative in this matter.

**Senator Lang:** They understand inflation.

**Dr. Foster:** Yes, they understand inflation very well. However, we are at the stage of writing the changes in the amending agreement now in detail. That will have to be approved by the governments when it is completed. So we are not in a position yet to divulge a number. However, it is a considerable reduction from the number of approximately \$100 million which we gave a year ago.

**The Chairman:** How about South Korea?

**Dr. Foster:** South Korea is a different type of contract, in that it was not competitive tendering, but a negotiated contract and it was two years later. So we had better information on the design of the plant we were offering and the likely cost of components. Because it was not competitive and could be negotiated there is a normal escalation provision. One of the difficulties with the Argentina one was that there was a ceiling required on escalation, that is, escalation up to a certain ceiling, and there is nothing like that contained in the Korean agreement, so it is a substantially better contract than that with Argentina.

**The Chairman:** If we have a kind of passive attitude toward sales abroad, would we not expose ourselves to getting the worst clients in terms of financial risk or military risk? Rather than selling more nuclear reactors, should we not pick our countries for sales? I would prefer Mexico.

**Dr. Aikin:** I should not have given the impression that we take a really passive attitude to this. We do encourage certain countries and are very much attracted to Mexico and hope to actively pursue that matter this fall. However, we do make selection of countries and go after those where we believe we have the best combination of possibilities and where the situation is favourable to us.

We recognize that some industrial countries will not buy a series of plants from us, but desire a licence and this is why we deal on the licensing route with countries such as Italy, Rumania and so on. Most countries are looking for an independence whereby they will be able to build their own nuclear power plants, recognizing that they cannot afford to continue importing them. These are the markets which we are entering, whereas the Koreans want a turnkey job in order to stimulate their own industry and we are limited on the amount of financing that would be put up for subsequent units.

No, I believe I over-emphasized the smallness of our staff on this matter but, in fact, we are looking for jobs. Do

not get me wrong; we would very much like to sell one plant a year.

**Senator Lang:** Shouldn't the U.K. be a pretty good target right now?

**Dr. Aikin:** Yes, I could go into the situation in the U.K. They have very much excess capacity in power generation at the moment. Their average load factor last year on the CGB system was 40 per cent of their installed capacity, so that they do not need to build plants for several years yet. This is why their whole program is just stalled.

**Senator Bourget:** Who are your strongest competitors for sales in foreign countries? Is it the United States?

**Dr. Foster:** It used to be the United States, but they have not sold many in the last couple of years. They were beginning to worry about this, but have just made some sales in Spain. Germany and France are the two coming countries in international sales. That is, they have made more sales recently. France for instance, has sold a couple of units to Iran and a couple to South Africa. Someone told me they were selling one to Korea, but I have not seen any confirmation of that.

**Senator Lang:** Pakistan?

**Dr. Foster:** Yes, Pakistan; they are selling a fuel reprocessing plant.

**Senator Bourget:** That is not yet settled.

**Dr. Foster:** No, that is not settled.

**Senator Bell:** And it is only rumour that anyone is selling to Uganda.

**Dr. Foster:** Yes, that is only a rumour.

**The Chairman:** Great Britain is out of that market completely now.

**Dr. Foster:** Yes, they do not have a plant to offer.

**Senator Lang:** Their technology seems to be in a bit of a shambles; am I not correct in that? At one time, the United Kingdom seemed to be making overtures to Canada to collaborate with them on this program.

**Dr. Mooradian:** Two years ago, the United Kingdom adopted the steam generating heavy water reactor, which is similar to our Gentilly-1, boiling light water reactor, except it uses enriched fuel instead of natural uranium. The U.K. had adopted it as the reactor it would develop for its future program. As recently as the beginning of this year, they were planning to commit half a dozen of these units—four for England and two for Scotland; but, as Dr. Aikin indicated, there is no requirement for power plants of any kind in the U.K. right now. This lack of requirement has created a problem for the U.K. in that if there is no pressure for decision, then all of the bright ideas get considered and reconsidered. As a result, there has been a great deal of rethinking of the SGHW design during the course of this delay.

**Senator Stanbury:** I believe Dr. Aikin mentioned the sale to Spain. I was in Spain about a month ago. I was aware of the fact that we were selling large amounts of uranium to Spain and that we had some difficulties with that contract. I was also aware that a Spanish government agency is involved in a joint venture with some Canadian



companies, and others, in searching for uranium in Canada. I was informed that Spain is planning to build some 21 plants over the next six years. It already has three or four plants in operation.

Can we not get any benefit tagged on to the sales contract in the way of the sale of uranium to these countries? Perhaps we are not in a position to participate in that type of development, but that would seem to be the type of commercial development that would be ideal for us to tag on to, using our supply of uranium as part of the benefit as a result of using Canada as the supplier of plants.

**Dr. Foster:** This has been considered, senator, but no action has been taken in that direction—that is, to tie CANDU sales to uranium sales. Perhaps it requires further consideration. Spain is exhibiting some interest in CANDU reactors. It has a planned program of about 20 light water reactors and has, I believe, three in operation. It is expressing an interest in CANDU reactors.

**Senator Bourget:** Just one final question on sales. Does the federal government assist you in financing or subsidizing these sales?

**Dr. Foster:** Not directly, senator. Of course, the EDC, the Export Development Corporation, finances these sales in the same way it finances the sale of any equipment from Canada. Other than that, there is no subsidy.

**Senator Godfrey:** You refer in your brief to the purchase of the Port Hawkesbury plant from Canadian General Electric Company. Were they willing sellers, or was it simply that there was a restricted market for the plant? Did the Canadian General Electric Company want to sell it to Atomic Energy of Canada Limited?

**Dr. Foster:** They were willing sellers at the time. The Canadian General Electric Company had a contract for the supply of heavy water which did not allow for escalation. It could not be adjusted, which made it very unfavourable to CGE. At about the same time, the U.S. parent company, GE, was wrestling with the question of whether to become involved in the enrichment business, and it came to the conclusion that enrichment was a business for government and not private enterprise, as a result of which it dropped out of that field.

There was parallel thinking between CGE and GE in this regard. Of course, Ontario Hydro was then in the Bruce Heavy Water Plant, which reinforced the general idea in the company as a whole that this was a field for government. All of these things led to CGE willingly selling the plant to Atomic Energy of Canada.

**Senator Godfrey:** You mentioned the fact that it had an unfavourable contract. Did you inherit that contract when you bought it out, or did that contract influence the sale price?

**Dr. Foster:** Atomic Energy of Canada was the customer. However, it was impossible to make any change in the contract. There was an arrangement for the sale of that heavy water, too, to Ontario Hydro. It was not possible for us to make a change in the contract.

**Senator Godfrey:** Approximately how much money was involved in the purchase of that plant?

**Dr. Foster:** Approximately \$66 million. I say "approximately," because the payments total \$93 million over a

period of years. The present worth is calculated to be \$66 million.

**Senator Bourget:** Dealing with the sale of isotopes and the cobalt-60 machines, do you still have a promising world market for those products?

**Dr. Foster:** Yes. Perhaps Dr. Aikin could speak to that.

**Dr. Aikin:** Dealing with the sale of isotopes, at one time there was a broad spectrum of isotopes sold for research purposes, medical purposes, and so forth. The number of isotopes that are now being sold has been greatly reduced around the world, with a concentration on particular ones. For medical diagnostic purposes now they use the technetium isotope, which is very short-lived, and this is produced right in the hospitals. We produce the molybdenum-99 from which the technetium is formed by radioactive decay of molybdenum. This market is building up very rapidly. We have gone from virtually no sales, or very little in the way of sales, three years ago, to about \$3 million worth of sales this year. We have become a major supplier of this material.

Dealing with the cobalt side, the principal use for cobalt was in medical beam therapy units for cancer treatment. Linear accelerators have now entered this field. We expected that we might get very severe competition and be eliminated from this market. In fact, the sales of the cobalt units have remained high. We are still selling about 50 a year. We are also getting into the accelerator market, which gives a more variable energy for the radiologist to use in these treatments.

The other area in which it was hoped there would be a large market generated for cobalt had to do with radiation sterilization of medical products, sterilization of food for preservation and for chemical reaction, and for specialty products. This market has not developed to the extent anticipated, although we have sold over 20 plants for radiation sterilization of medical products. We supply most of the world market in that area. We are not selling them as fast as we had originally hoped, but there are indications that the market is picking up again and we are hopeful that we will be able to continue to sell in that field and start making some money.

**Senator Bourget:** Thank you.

**Senator Lang:** From what you said at the outset, Dr. Foster, I presume you envisage that the R&D activities of AECL will continue *ad infinitum*?

**Dr. Foster:** As far ahead as we can see, anyway?

**Senator Lang:** Yes.

**Dr. Foster:** Yes, very much so, senator. We envisage that these R&D activities will continue to expand in support of nuclear power programs, medical radiation, and in biological and other areas.

**Senator Lang:** I made that remark and asked the question because there have been some assumptions that since its inception AECL was to perform a particular function by government because of certain circumstances at that time. It was assumed that when the establishment of a viable nuclear energy base was founded in Canada, AECL would foster technology in the private sector of the market place. This is being presumed by some people but I take it that you are here to stay as far as we can foresee.

**Dr. Foster:** The point is that there is a long-term relationship concerning nuclear power stations, and we have been responsible for a certain amount of this. We move up to a certain point, but there is a need for improvement, let us say, with reactors or in the fuel cycle that we were talking about, and so on.

Again, if we can go back to the aircraft industry, the money spent in that industry is a continuing matter. It has required the infusion of government funds and efforts throughout its course. The same is true with respect to nuclear energy. As soon as part of it can be done by other organizations, we would like to see this done. For instance, the amount of engineering that we are doing in connection with power plants for Ontario Hydro is diminishing. Ontario Hydro are picking up more and more and we are only too happy to see them do it.

In the marketing of reactors overseas, we would like to see customers get to a more sophisticated point so that they buy more, like domestic customers, and not accept jobs with big financial and technical resources behind them. We would like to see them prepared to buy plants in parts, the way they buy other conventional plants, so that engineering construction organizations from Canada would be involved rather than our being involved. We would look after getting the plant to the dock site and have everything else done overseas, so that when private organizations could take over we would be only too happy to see them do so.

**The Chairman:** If they cannot do it domestically how do you expect them to develop a capability in the international market?

**Dr. Foster:** They are doing these things domestically. In the case of Ontario Hydro, Ontario Hydro does the construction itself and the design of the conventional end of the plant, and they purchase all of the equipment. We produce the specifications, and so on, and if we go to New Brunswick, which is a good example, they are doing the engineering of the conventional end, with some assistance from consulting engineering organizations, and they are managing the job in the field. We are not. Now, we do not have a technical contract with New Brunswick to supply the power plant; they are dealing with it in pieces. This is what we would like, to have Canadian commercial organizations take the responsibility for putting the overseas plant together.

**Senator Lang:** Of course, my remark was really directed towards an effort to foster technology in the Canadian scene.

I notice in the government's Scientific Activities Survey, '75, you have expenditures in the universities of some \$717,000 out of a total of some \$90 million, which would seem to me to be a very modest commitment to university research considering the nature of your activities.

**Dr. Mooradian:** Perhaps I could pick that one up, and part of your previous question, Senator Lang. We are not a granting agency; we contract with the universities. In that way we are quite different from the NRC. NRC receives proposals for grants from universities, and this is one of their major functions—the development of the scientific infrastructure in universities. We are very crass in our dealings with universities. We only pay for something that we want from them in the area of special expertise. For example the University of Waterloo has a very good

hydrology department, and we contract with them to do hydrological surveys.

Our terms are quite different, but we do assist the universities in several other ways. We assist them in the development of curricula; we assist them in giving them free use of any specialized equipment we have and some of our equipment is used to the extent of about 50 per cent by the universities. We operate the equipment and the scientists are free to use it. We have attachments from universities and we do a lot of lecturing at universities on their behalf in our specialized field. We also take industrial internships for students. Some of our staff sit on Ph.D. examinations, for example, and some of this Ph.D. work is done in our laboratories. But our relationship with regard to direct expenditures with universities is strictly on a contract basis. We ask the universities to do work that we want done.

**Senator Lang:** What I think I might be concerned about, and perhaps unnecessarily, if I were in your position would be the virility of my own R&D and in-house effort. Taking the lifespan of AECL right now, what is the average age of your researchers?

**Dr. Mooradian:** Between 37 and 38.

**Senator Lang:** You are getting to the danger point. You obviously have to look now to Canadian universities for replacements for your most creative minds for the next decade. Are those men there?

**Dr. Mooradian:** Well, as you are probably aware, we have a summer student program as well which is meant to get intercourse with the universities at the graduate student level. This year I have had to trim that program back to about the same percentage as others in this austerity year. But we have a significant influx every year of students from the universities, and the greatest value of that program is to bring these young people in so that they can assess us and we can assess them and produce mutual stimulation as between the universities and the laboratories. We give something like 300 lectures a year at universities, and we have university staff called in in a co-operative program. We do not hesitate to consult with them.

But if you are asking as to whether I am concerned about the infrastructure of the scientific community, then that is another question. If I may, I would like to get back to part of your original question. We have learned some things in the laboratory over the past 20 years and one of these is that building a device and building an industry differ by about two orders of magnitude. Building Douglas Point and doing the technology for that, and building the basis for a Canadian nuclear industry differ by some orders of magnitude, and I would like to give you some examples of how some of our effort is now being applied in getting it out into industry. We are operating reactors and the excellent operating record at Pickering is not an accident. We work like hell to keep that thing with that kind of pace. You get a leak in a boiler tube. The problem; how do we get in, out, with a minimum of down time and have the service available to the utilities of the country that continue to draw on the laboratory. We took that problem, developed an automatic device, brought in the industrial inspection agency, trained them right at that point while we were developing the device. The first opportunity came up on a leaking boiler tube in Pickering and we were able to get in, find the tube, seal it, and get out of the place and get the plant back in operation in 48 hours. Now there are hundreds of thousands of tubes in that plant, but the impor-



tant thing is that when the next boiler tube leaks these people do not have to come back to Chalk River because they are brought in on the technology immediately. So we are getting feedback problems from the operating reactor as to the viability of the reactor.

Another problem is how to control the radiation levels in the out-reactor circuits. The control board has very stringent regulations on the radiation that each individual can receive. It takes very little material to become radioactive to settle out in the circuits. We have a major program to bring people in directly from the operating reactors and bring them into the laboratories as a team. We have about three different lines of attack on this, and with very good results so far. When we are finished that job we will have people who can make purification equipment in this country. With regard to water leakage, there was not a valve available that would meet the criteria that we wanted. We worked with two valve suppliers in this country and as a result the export sales of nuclear valves is larger than the domestic sales at the moment. But we developed the valve type in collaboration with the industrial contractor. We have done that kind of work under industrial contract, and this in a different type of ball game entirely from sitting in a laboratory trying to come out with a unique piece of equipment. It takes time and it takes money and it takes major intercourse to even develop a sense of mutual respect—for the industrial supplier to think of us as something more than eggheads who do not know which side is up because we have never been in the crass commercial game, and for us to respect them for the experience and technology they have. That is a three-year job.

**Senator Lang:** You indicated that you might be willing to comment on the general scientific infrastructure and I think the committee might like to hear your views. Dr. Gray when he was here in 1968 was predicting a pretty dire future for our physical scientific community in view of our overproduction of Ph.D.'s at that time. I do not know what happened to that overproduction; perhaps they have all left the country as Dr. Gray predicted. But we seem to be badly out of balance.

**Dr. Mooradian:** Well, I have no precise numbers on this, but it would not worry me that there is not a university job or an apparent research job in a government laboratory for a Ph.D. who has graduated. What would worry me would be to have Ph.D.'s who do not have the get up and go to find the niches that are required in the industry to make use of themselves. We have been in the state of almost total feedback for a period of between 10 and 15 years in just generating the Ph.D.'s required to expand the universities to a level thought to be necessary to produce the technological talent which this country is going to need. We have gone through an era during which the universities have been introspective and had to be just to build the educational infrastructure required. Now we are going into another era where we have developed our talent for producing first-rate people and the next question is, "How do we use them?"

The next question is: How do we use them? At least we are in that sort of enviable position. If the academic attitude and the industrial attitude overlapped to any great extent at the moment, I do not think I could support that statement. If I said that the pressure is developing now to get the first-rate talent diffused into our industrial infrastructure, I think that is correct, and it does not worry me a bit to find the best people in our country diffusing. We come across companies that badly need people but do not

realize it. We have had a manufacturer come out with a loss of \$300,000 worth of tubing in one batch because they did not have a metallurgist. That is one of the largest engineering companies in this country. We cannot afford that kind of thing.

It does not worry me to see us developing large numbers of first-rate, highly-trained people. To do that the time constant is something like 15 to 20 years. If we want to turn that off, we had better be very sure that we know the future is not going to need them. What I can see for the future are two major problems. We have got almost to rebuild the whole energy system—and nuclear energy is only one part of it—and we have got to start supplying food and shelter for a very much larger number of people in this world. We have got everybody demanding that the ratio of leisure time to production time should increase, so our productivity has to increase. We have got lots more leisure and non-productive hours to support with productive hours. The only way I can see those productive hours increasing in value is to improve the technological posture of the country. That is the only device I know. I have not seen a union contract yet that asked for less money and longer hours.

**The Chairman:** Not even at Chalk River.

**Dr. Mooradian:** No, and I have got 14 of them.

**Senator Godfrey:** I used to argue when I was with the Canada Council that surely there were other uses for Ph.D.s except being university professors.

**Dr. Mooradian:** They are well trained. When I graduated with my Ph.D I did not give it much value. It was only about three years later that I realized I was thinking about things in a different way from somebody who did not have a Ph.D.

**The Chairman:** Perhaps we should now move to the relationship between AECL and industry.

**Senator Bell:** Before we do that, I should like to ask one question. I am curious to know why you stopped work on the organic coolant.

**Dr. Foster:** The basis of your question must be that you know that technically it looked pretty promising, and it still does. We have had loops in the reactor out there, operating at conditions bordering on conditions that would be good for power generation. Certainly it has certain attractions—more efficient cycle, which is worth something, lower activity in the cooling circuit most of the time, which is an advantage, people can get around the equipment and so on. It has these technical attractions. However, getting from a technically successful demonstration on that scale to full commercial application is a very big operation, which requires the co-operation of many important organizations. Utilities could not afford to feel that a major piece of plant on their system was dependent on a very small development base. The water reactor business is an international business. We are using heavy water and natural uranium instead of light water and enriched uranium, but it is uranium oxide in hot water systems and so on, so what we are doing all around the world is very consistent and inter-supporting.

To take the organic system through to that kind of stage requires a very big co-operative effort by many organizations, and in my opinion not just in this country. We have not forgotten about it. Twenty years from now it may be very worthwhile to develop that system, to use the thorium



cycle, and we will have a much bigger base, all of us in this field, in nuclear power, and it may very well be an attractive system to take up at that time. However, we do not have to have it now, and there are not the big resources necessary to take it through to completion.

**Senator Bell:** So it was not a bad mousetrap?

**Dr. Foster:** No, it looks like a pretty good mousetrap; I think it will catch mice.

**Senator Yuzyk:** Before you leave the subject, Mr. Chairman, I should like to ask this question. Fossil-based fuels are exhaustible, of course, and unrenowable. I suppose atomic energy is classified as a renewable source of energy, is it?

**Dr. Foster:** No, not really. It has a limited resource. Of course, the total quantities available in the earth's crust are very great. We do not know yet what the concentrations are or the effort required for recovering them, so we cannot say just how big these resources are. Of course, we have very efficient systems in prospect for exploiting them. They are big resources, but they are of the same nature as fossil resources.

**Senator Yuzyk:** But it is more long range?

**Dr. Foster:** Yes.

**Senator Yuzyk:** That leads me to this question. Today, scientists, governments and people are considering a more permanent basis of energy, namely solar energy. I am sure that you must be thinking along these lines, how you can relate atomic energy to the production of solar energy. Are you working in that field at all?

**Dr. Foster:** We are not doing any active work on the further exploitation, as I prefer to call it, of solar energy. After all, we are dependent on the sun for 99.5 plus per cent of our energy, and what we are talking about here is that extra bit of energy that we need and want in a particular form in the right place, such as light, heat and so on. The attraction of solar energy, as you say, is that it is renewable, it is continually arriving. Well, almost continually arriving.

**Senator Stanbury:** Except at weekends.

**Dr. Foster:** Yes, that is right. It may be possible to exploit it in better ways for home heating. We use it to some extent now, in that the brick wall at the south end of the house does part of the job. We have an interest in solar energy and the further exploitation of it. It is just one other source of energy that will be very valuable in the future, but we are not ourselves doing anything directly on it at the moment.

**Senator Yuzyk:** I just wanted to know if you are thinking about it and I am sure you are, because there are more applications for solar energy than just heating buildings. It will be possible in the future to see many valuable uses of solar energy.

**The Chairman:** Again, we will meet witnesses this afternoon who will be more directly involved in this. May we return now to the relationship between AECL and industry in relation to the make-or-buy and the contracting-out policy?

**Senator Bourget:** What proportion would be contracted out to industry?

**Dr. Foster:** In the way that MOSST tabulates this information, my recollection is that it is approximately one-third, 20 related to 50, of our expenditure. However, when I was looking back at what Dr. Gray had to say at the session in 1968, it depends on how the bookkeeping is done. Of the money we spend in-house, much goes out to industry and it is not all salaries of AECL personnel. Much of it is for the purchase of equipment, which requires a certain amount of development by that organization and an upgrading of their capacities in order to provide such equipment. However, basically the way MOSST handles it, it is about one-third.

**Dr. Aikin:** It is a quarter.

**Senator Bourget:** Is it \$40 million out of \$96 million? Intramural activities is \$81 million.

**Dr. Foster:** It is approximately \$27 million out of \$90 million; about 30 per cent in that case.

**The Chairman:** Could we be sure as to these figures? \$96 million is the total R & D expenditures?

**Dr. Foster:** \$90.5 million using this tabulation and \$26.9 is in Canadian industry; \$62.08 is intramural.

**Senator Lang:** I believe these are Statistics Canada figures.

**Dr. Foster:** Yes, produced for MOSST by Statistics Canada.

**The Chairman:** Has this been increasing, or decreasing in the last few years?

**Dr. Foster:** No, I believe the ratio has been approximately the same, 22 out of 83.3 for the year 1974-75; 23.5 out of 85.9 in 1975-76; and 26.9 out of 90.5 in 1976-77.

**Senator Bourget:** With respect to your accounting system, have you changed it so that it will reflect better the work you do in-house and that work which is contracted out? Dr. Gray mentioned that at that time it did not reflect exactly the amount of work that was done in-house and the work done outside.

**Dr. Foster:** No, I could not say that the accounting system does that any better. It is information that we must extract because, of course, the accounting relates more directly to the programs and the projects within the programs, or primarily to that and secondly to this type of application, so it is extracted information.

**Dr. Aikin:** We extract the information in order to be able to supply this according to the MOSST and Statistics Canada guidelines. We are establishing an accounting system on our R & D projects whereby we will record this information and tabulate it for computer programs. We will be able to collect it in a variety of ways just by running the programs. This is something we have done before, but now we are a lot more interested in analyzing these expenditures in different ways, so we are now proceeding to do this. During the past year we have developed an accounting system to do this. It is quite different from our financial accounting and is tied in with our program accounting. The research sites at Chalk River and elsewhere have been working on this.

**The Chairman:** But would you say that the figures we have here at our disposal are significant and truly reflect your operation?

**Dr. Aikin:** I think they are very close to reflecting the ratio of in-house to industrial expenditures. The point Dr. Gray made was that the in-house expenditures include the purchase of a great deal of equipment, which are purchase orders which go back out to industry. However, following the guidelines as laid down so that all departments have this consistent policy, this is the type of distribution that we have, compared to other organizations.

**The Chairman:** The purchase of equipment would certainly not be part of what you contract out on the make-or-buy policy.

**Dr. Aikin:** No.

**Dr. Mooradian:** However, for some of the equipment that we buy, we work very closely with the supplier. With respect to the percentage of that, I cannot give you a figure, but when we ask someone to supply a piece of equipment we sometimes will work very closely with them. For example, we are buying a spectrometer now and we are putting almost as much time into getting across to the manufacturer what we require as we do in the case of an industrial contract. To give you an example, we needed a heavy water spectrometer which we had developed. We thought that there was a need for something like six and went out to the possible purchasers, packaging up an order for six of them. Now, we had not reduced to an industrial design the equipment that we had developed in-house to do this job. So we gave a complex contract to them saying that it was for the supply of six industrialized monitors. So a part of that contract would transfer technology to Chalk River and the supplier and we work very closely with them. When we were satisfied that we could put a label on, yes, this is a very good piece of equipment, we advised the purchasers to forward their purchase requisitions for this equipment. So that was a purchase requisition, but it was, in fact, a development contract.

**The Chairman:** But as your development work becomes in certain areas, at least, in the more classical areas, less complex and difficult, do you contemplate that in future years you will be in a position to contract out more of that type of work to industry?

**Dr. Mooradian:** I hope the answer is yes, because we have a great deal to do. We are endeavouring to get rid of our jobs, clean the slate and get on.

**The Chairman:** We would not ask for that much.

**Dr. Mooradian:** I believe that our laboratories are a tremendous national asset. There are just a few places in this country in which we have the capacity to take something all the way from the research effort out to a demonstration and we think at significant cost to the Canadian taxpayer we have done that. We have made some mistakes and had some successes. I do not believe we are any better than any other establishment; it is just that we have had more feedback on it. These are the pieces of the infrastructure we are trying to build. Ontario Hydro continually needs to be updated on being a good customer; it costs a lot of money to be a competent customer. We train their people in our labs, people that they have hired and trained. They will raid our laboratories occasionally, with our consent. In that way, we can transfer a fair bit of knowledge and expertise. There are parts of the job which, because of the lack of experience, they cannot do, such as the Pickering pressure tube problem, which we will take care of. The Pickering pressure tube problem was a very complex,

interdisciplinary one. With the talent we have, it took us approximately three weeks to really nail down exactly what it was. They cannot do that yet, but they can certainly develop specifications now for the next batch of pressure tubes, which is something we used to help them with. They can develop specifications now for a large number of pieces of equipment. That is a piece of the infrastructure. Ontario Hydro is in relatively good shape because it has a program large enough to be able to support this type of infrastructure.

The next one on the line is Hydro-Quebec, and we are negotiating with Hydro-Quebec to get its research organization integrated into that type of operation. That process has just started. That is one type of interface where there may or may not be a transfer of money, but when I take a man from Hydro-Quebec's labs into my lab, it costs me money, but it is not something that is charged to Hydro-Quebec.

**Senator Yuzyk:** Do some of your personnel actively participate in the labs in the production of some of these articles that you require?

**Dr. Mooradian:** Yes. As an example, a critical piece of equipment unique to the CANDU reactor is the pressure tube. Until recently the market for the pressure tube was not large enough to stimulate a Canadian-based industry. We now feel that the production of pressure tubes, in combination with boiler tubing, constitutes a good base for industry. We are working hand in hand with IT&C in stimulating companies to become involved in this area, and one of the ways that we do this is to have a team available to these companies where we have actually walked in, performed a demonstration run, and actually purchased tubes from that demonstration run. That, again, does not show up as an expenditure. However, we do purchase the first pressure tubes coming off this line so that we can inspect them, thereby helping the company in question meet our specifications.

**Senator Yuzyk:** That is a boon to companies, then, going into this field.

**Dr. Mooradian:** Yes. We have a very good relationship with these companies. The companies we deal with, we feel, have a very receptive attitude towards us.

**Senator Stanbury:** My question, Mr. Chairman, relates to my earlier question about certain benefits being attached to sales.

What has kept Canadian industry from being equipped to supply the equipment necessary when CANDU plants are being constructed in foreign countries, or in Canada, for that matter? What is it that has not been done that has made it impossible for Canadian industry, with a certain advantage in research in this country, to do what German industry has been able to do, or French industry has been able to do?

I appreciate there are advantages of scale, but the scale is available to us, apparently, in the world. Why have we not been able to develop our industry to take advantage of this technology?

While I appreciate and respect what you have said about the way in which you are involving industry at the present time, is it perhaps because you did not sufficiently involve industry at an early enough stage?

**The Chairman:** I am afraid it will be a long story.



**Dr. Foster:** To a large extent, Canadian industry does do what foreign industry does in terms of manufacturing components for Canadian and overseas plants. There are one or two areas where foreign industry is further ahead. For example, we do not produce our own zirconium. There are also instrumentation and computer components which we do not manufacture in this country to the same extent they are manufactured in France or Germany; there are stainless steels that are not manufactured in Canada to the same extent, again, that they are manufactured in other countries. That also applies to some parts of turbo generators. Apart from those items, Canadian industry manufactures the same components as foreign industry.

If you are thinking in terms of a company selling a power plant taking over all responsibility for that power plant, there is a difference between Canada and Germany. The situation in Germany is that two companies, Siemens and AG, which are involved in this area, and Siemens, of course, is of a different order from any company we have in Canada. The United States now has three companies in the export market on this basis, General Electric Company, Westinghouse, and BMW. BMW has just recently become involved, having sold one to Spain. Again, they are much larger than Canadian corporations. Even in France, one group, partly made up of government and partly industry, handles this field. The same applies to Sweden. As far as manufacturing components, other than the exceptions I mentioned, Canadian industry manufactures the same items as are manufactured in those other countries.

**Senator Lang:** How many people do you employ in R & D work above the technician level, approximately?

**Dr. Mooradian:** Between Whiteshell and ourselves, we have about 600 professional employees, 50 per cent of whom are at the Bachelor level, 15 per cent at the Masters, and 35 per cent at the Ph.D. level. Of that 600, my guess is that approximately 200 would be ascribed to what would normally not be called R & D, but fellows on the workbench, such as engineers working on the development of special equipment. Each experiment we put into a reactor has to go through the whole regulatory evaluation of whether it leaves the reactor safe or not. So, we have professional people who are involved in that type of assessment, professional people who are operating sophisticated equipment.

We have professional people who, in that sense, are actually operating. My guess is that about 200 of the 600 professionals are in the operations and design of experiments, with some administration.

**Senator Lang:** What would your annual intake be?

**Dr. Mooradian:** At the moment, zero, but on the average—and again I would be guessing—it is in the order of 40.

**Senator Lang:** Forty a year?

**Dr. Mooradian:** Yes.

**Dr. Foster:** Now, this is turnover.

**Senator Lang:** Oh, you are talking turnover. I am talking about induction, really, new people that you would bring in from universities each year?

**Dr. Mooradian:** Well, that is not far off the pace. For the laboratories most of those we hire are fresh university graduates. That is not quite so for power projects. They

require experienced engineers at different levels. But we do most of our hiring directly from graduate schools or undergraduate schools.

**Senator Lang:** So, on an average you would be bringing in around 40 a year?

**Dr. Mooradian:** Yes.

**The Chairman:** Senator Godfrey?

**Senator Godfrey:** Does it hurt, does it help, or is it mutually satisfactory that you are getting these professional people at Chalk River?

**Dr. Mooradian:** That is a very good question. We have debated that internally a fair bit. I would say now that it is probably a help, and it is just the difference in what young people are looking for. Nature has suddenly become quite popular. We tend to attract people who are attracted to that kind of location. I guess the right answer is that we do not have difficulty in attracting people to Chalk River. I would say that it is a combination of two things. For the employees, since we are bringing them in fresh, I would say it is a question of whether or not it is a good place to further their training, because at that point they are not looking forward to a full life in Chalk River.

**Senator Lang:** Do you meet all your recruitment requirements for graduate students from Canadian universities?

**Dr. Mooradian:** We can from Canadian citizens.

**Senator Lang:** But not necessarily from Canadian universities?

**Dr. Mooradian:** That is right. I have not got the precise numbers on this.

**Dr. Foster:** The statistics are here.

**Senator Lang:** Do we have a significant shortfall or a minimal one?

**Dr. Aikin:** It is quite minimal.

**Dr. Mooradian:** Even now for our doctorate fellowship programs, we have no trouble in keeping that at 50 per cent Canadian content or higher.

**Senator Lang:** And that is Canadian university graduates?

**Dr. Mooradian:** That is right.

**Senator Bourget:** And you are satisfied with their training and motivation?

**Dr. Mooradian:** Oh, they are good. I would hate to have to compete with them!

**Senator Yuzyk:** I have just one, general question. How does AECL relate to MOSST in carrying out policies of science and technology?

**Dr. Foster:** Dr. Aikin?

**Dr. Aikin:** In brief, very little.

**Senator Yuzyk:** Very little?

**Dr. Aikin:** Yes. We are aware of MOSST but our program is reasonably well defined and it has been evolving over the years. A few minutes ago I was tempted to summarize the quite major changes that have taken place in our R&D

program in the last 8 years since we were first before this committee but, in fact, although we know the people in MOSST there has been very little discussion with MOSST in terms of program planning.

**Senator Yuzyk:** You have no permanent arrangements for consultation, discussion, co-operation, et cetera?

**Dr. Aikin:** No, there are not at the moment. I could add that there is now an energy R&D panel, which I am sure you are aware of, chaired by the Senior Assistant Deputy Minister of Energy, Mines and Resources, and our expanding programs are reviewed at that panel.

**Senator Yuzyk:** Are you satisfied with the present relations that you have with MOSST, or would you like to see them improved?

**The Chairman:** I am sure he is satisfied. He has no relations.

**Senator Godfrey:** Is that the criteria of being satisfied with MOSST?

**Dr. Aikin:** Well, we think perhaps now that MOSST has been reorganized and now that they are setting their own targets and objectives and are starting to play more of a role in the total R&D picture in this country, that we should be communicating a lot more over the next short while, but I have to be quite frank and say that up until now there has been virtually nothing.

**The Chairman:** Do you not have to show them each year your proposed expenditures before they are finally approved by Treasury Board?

**Dr. Aikin:** We submit them to Treasury Board directly.

**Dr. Foster:** There is a requirement that MOSST see them. It was two or three years ago that that came out, but it has been, or is being, I think is the way to put it, to a considerable extent superseded by the activities of the Energy R&D panel, and since most of our R&D is related to energy, that tends to take that place.

**The Chairman:** I have two brief questions. Do you still work on ING?

**Dr. Foster:** No. There is no activity on the intense neutron generator, but there is a development work that I mentioned relating to spallation and so on that is a descendant in a way.

**Dr. Mooradian:** On ING as a project, no, but on some of the select technologies that were required for it, yes.

**The Chairman:** In the course of your R&D activities, do you occasionally come up with a new invention which is not really in your main mission, and what do you do with that since you cannot exploit it?

**Dr. Aikin:** We patent it and we work together with the Canadian Patents and Development Corporation and turn it over to them for them to exploit it.

**The Chairman:** Does this happen often?

**Dr. Aikin:** Not very often.

**The Chairman:** You do not find many things out of your own field?

**Dr. Aikin:** Well, people come up with some good ideas and sometimes the inventor thinks it's a wonderful idea and wants to submit it to industry and circulate it through the devices that Canadian Patents have for circulating these ideas, but very few of them get taken up by industry.

**The Chairman:** We hear a lot about spin-offs, but apparently it does not happen at AECL.

**Dr. Mooradian:** Well, perhaps the accelerator program is worth mentioning. We came up with the bright idea of making use of an accelerator of the type that we developed in LINAC for a different purpose and to meet the objectives of the switch in emphasis among the radiotherapists from cobalt to accelerators who were aware of that, and intimately so, and so some of our people came up with a scheme where by using one accelerator we could get twice the energy from the same structure by a device that we thought was workable. So we built one and tried it and it worked.

**Senator Bourget:** And it was safer?

**Dr. Mooradian:** It may not be, but these all have to meet some very stringent criteria for therapy machines. But we are in the last stage of developing that machine and we think it is as good as or better than anything else on the market.

**Senator Yuzyk:** Is the market aware of it?

**Dr. Mooradian:** Yes. We are in a position, in this case, where Commercial Products is aware of the therapy market and is in a position to exploit it. Also we keep our eye on things like neutron generators. There are some indications from experiments done at Hammersmith Hospital that neutrons might be a good particle for irradiating for cancer treatment. There is a long lead time from that type of experiment to widespread application, but we know quite a bit about neutron generators, and we have been able to come up with an idea that requires a lot more exploitation, and we will have to work with an experimental hospital to get that utilized. It is quite a long process to actually get to the point where somebody is prepared to put down a buck any buy one.

**Senator Yuzyk:** A very useful spin-off.

**The Chairman:** Well, it is already past 12.30 and I want on behalf of the committee to thank you, Dr. Foster, and your colleagues for being with us this morning even if it is during the month of August. Thank you very much.

The committee adjourned.





Appendix "31"

**Atomic Energy of Canada Limited**

**SUBMISSION**

**TO**

**THE SENATE OF CANADA**

**SPECIAL COMMITTEE ON SCIENCE POLICY**

**1975 Addendum**

**June 1976**



## ADDENDUM

October, 1975

to the Atomic Energy of Canada Limited Brief

Dated October, 1968

to

The Senate of Canada Special Committee on Science Policy

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The purpose of this addendum is to present modifications and additions to the information contained in the subject brief that have occurred in the period between October, 1968 and October, 1975.

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## ATOMIC ENERGY OF CANADA LIMITED

Submission to the Senate Special Committee on Science Policy

Statement by J.S. Foster

President, Atomic Energy of Canada Limited

Mr. Chairman and Gentlemen,

In the preparation of AECL's submission on its scientific activities our approach has been to provide information and data to supplement and bring up to date that which we tendered to the Committee in 1968.

2. Since the earlier submission, the scope of endeavour of AECL has broadened, not only in the nature of the Research, Development and Demonstration performed, but also in the assumption of two new commercial activities: the production of heavy water and the export of nuclear power plants. In these commercial activities AECL is playing an initiating and sustaining role. With regard to heavy water, AECL is supplying the requirements of the market outside Ontario. This market is still rather thin and somewhat difficult to predict. In the field of international trade in nuclear power systems customers require of their suppliers the technical and financial resources of commercial giants or governments. As a consequence, there are only seven international supplier organizations. Three of these fall in the category of commercial giants: General Electric Company and Westinghouse of the United States and KWU (a consortium of Siemens and AEG) of the Federal German Republic. Canada and Russia are represented by governmental organizations: France and Sweden by the hybrid organizations, Framatome and ASEA-Atom, respectively. The breadth of AECL activities

is given more fully in a paper presented by me to the 1975 CNA Conference and included as Appendix 16.

3. The primary role of AECL is still, however, Research, Development and Demonstration in the field of nuclear energy. With the passage of time a clearer perception of this role continues to unfold. The chief objective is, as it always has been, to develop in Canada, from ivory tower to shop floor:

- (a) the knowledge to enable the country to obtain from indigenous nuclear resources abundant useful energy in a clean and safe manner for as far as one can peer into the future;
- (b) the capacity to enable the country to play its part in disseminating that knowledge so the world-at-large may have the benefit of abundant energy; and
- (c) the knowledge to exploit nuclear energy in more precise ways for the improvement of the health, nutrition and working environment of mankind.

4. The technical feasibility of nuclear fission for the production of energy was indicated more than 30 years ago. After major development efforts embracing the whole of the industrial world, it is now an assured source of major amounts of energy for the immediate and, if necessary, distant future. Together with coal, it is an established successor to oil and gas in this respect. The importance of continuing R, D and D in this field is evident. Alternative energy sources, in particular solar energy, and eventually, it is to be hoped, the fusion process may augment or, in the latter case, displace fission energy.



AECL endorses the development of such alternatives and any others that appear to be practicable. However, its own near-term efforts must necessarily be concentrated on the fission process and auxiliary matters.

5. During its first 20 years the Company was preoccupied, in the field of nuclear electric power generation, with the development of a nuclear steam supply system that would provide the most efficient, economical and tractable method for the ensuing quarter-century for extracting energy in useable form from uranium. This resulted in the CANDU system and culminated in the successful commissioning of the Pickering Generating Station which, alone, produces nearly 5 percent of Canada's electricity.

6. The Company's future R, D and D program in this field spreads out, both in breadth and in reach, from this initial development. The program extends laterally to embrace research and development into improvements in heavy water production methods on the one hand and the safe, ultimate storage of residues from spent fuel on the other. In reach, the program embraces:

- (a) for the immediate future, the development work required in response to operational experience with existing plants;
- (b) for the next quarter-century, research and development related to improvements and extrapolations in design for units of up to 2000 MWe capacity;
- (c) for the turn of the century, research, development and demonstration of more efficient fuel cycles employing thorium and recycled fissile material;

- (d) for beyond that, research and development into electronuclear breeding through the production of neutrons by the nuclear spallation process which, if successful, would, in the next century, provide virtually unlimited amounts of energy from heavy elements; and, finally
- (e) awareness of research and development of controlled nuclear fusion so that if, as and when, this process shows promise Canada will be in a position to react knowledgeably.

This program together with that concerned with research into medical and other applications of radiation is supported by important underlying research in the relevant scientific disciplines, such as physics, chemistry and biology.

7. In all of these activities close cooperation with Canadian utilities, industry and universities is as important as it ever was - perhaps increasingly so; as is also the cooperation with complementary organizations in other countries. The success of the CANDU system has stimulated greater foreign interest in collaboration with Canada in this field and has shifted that interest away from scientific exchanges toward knowledge relative to application.

8. The arrival of nuclear power as an important energy source has had a profound effect on the relations of those in the business with the rest of the world. Its importance has led to the involvement of administrative organizations at all levels and in many facets of government. Although nuclear energy has had an exemplary safety record (while providing as much electricity as did all primary sources

during the first 50 years of the electrical era), it has become an object for concern and criticism among a part of the population because of misconceptions of the potential for harm. Its importance in the already important field of energy, the necessity of administrative involvement, the public concern, and the attractions of success have made nuclear energy a major political topic, occasioning increased interaction between those working in the nuclear field and the world-at-large at the political level. The expanded intercourse with the rest of the world has diverted research and development talent from the technical sphere to the sphere of human relations. Although this is a new experience, in the long run the performance of R and D may very well benefit from this new dimension.



BRIEF HISTORICAL BACKGROUND

1. In the period since preparation of the October, 1968 brief, the Douglas Point station has developed into a reliable generating unit in the Ontario Hydro system. As of October, 1975, approximately half the steam produced by the reactor is used as process steam in the nearby Bruce Heavy Water Plant while the other half is fed to a turbine to produce electricity.
2. The four 540,000-kilowatt units of the Pickering nuclear power station came into full production successively in the period from 1971 to 1973.
3. The 250,000-kilowatt unit, known as Gentilly-1, which was built in co-operation with Hydro-Quebec, produced its first power in 1971.
4. Also in 1971, the 137,000-kilowatt unit, KANUPP, built by the Canadian General Electric Company for the Pakistan government, came into operation.
5. In India, the first unit of a station similar to Douglas Point produced its first power in 1972. A second unit at the same site is reported by the Indian government to be scheduled for operation in 1976.
6. In 1968, Ontario Hydro committed a new station, the Bruce Generating Station, which consists of four 750,000-kilowatt units. The first of these units will come into operation in 1976 and the last in 1979.
7. Hydro-Quebec has begun construction of a 600,000-kilowatt unit at the Gentilly site. This will produce its first power in 1979.
8. New Brunswick has also begun construction of a 600,000-kilowatt unit similar to that in Quebec and also scheduled for first operation in 1979.

Appendix 1

9. In Ontario, the provincial government has committed an additional four 540,000-kilowatt units to be built at the Pickering site. Construction has begun and the units are scheduled for operation in the period from 1980 to 1982. Plans to construct four additional 750,000-kilowatt units at the Bruce site and to construct four 750,000-kilowatt units at a site near Darlington are also well along. A conceptual design for a station consisting of four 1,250,000-kilowatt units has been prepared.

10. In the overseas market, commercial contracts for 600,000-kilowatt units similar to those being constructed in Quebec and New Brunswick have been signed for single reactor units to be constructed in Argentina and South Korea.

11. In summary, at present nine reactor units with a designed capacity of 2,800,000 kilowatts are in operation - seven in Canada, one in India and one in Pakistan. Twelve additional units with a designed capacity in excess of 7,000,000-kilowatts are under construction and nine units with a designed capacity of about 6,800,000-kilowatts are being planned. All are expected to be in operation by 1985.

12. In 1969 Cabinet authorized AECL to build a heavy water production plant to be known as the Bruce Heavy Water Plant on a site near the Douglas Point reactor. This plant with a nominal output of 800 tons of heavy water per annum went into production in 1973. In 1973 the plant was sold to Ontario Hydro.

13. In 1971 as a result of an agreement between the federal government and the Province of Nova Scotia, AECL was authorized to undertake the rehabilitation of the Glace Bay heavy water plant. This work is now almost complete and heavy water production is expected to begin early in 1976.

14. In 1975, with the approval of the federal government, AECL purchased the Port Hawkesbury heavy water plant from the Canadian General Electric Company.

15. Construction of a heavy water plant with a nominal output of 800 tons of heavy water per annum was begun at a site near the Gentilly nuclear power station in the province of Quebec. This plant is called the La Prade heavy water plant. First production of heavy water is expected in 1981.



BACKGROUND AND PROSPECTNuclear Power

1. AECL's brief submitted in 1968 contained a forecast of the nuclear power generating stations to be installed from then until the year 1990. A similar forecast today must take into account several major developments that have occurred since 1968.
2. First and foremost of these has been the successful startup and operation of Canada's first commercial nuclear generating station at Pickering. This has established the CANDU system as a viable option for the supply of electrical energy where and when required.
3. The second major development has been the sudden awakening of many people to the vulnerability of supply and rising cost of petroleum which today supplies about three-quarters of Canada's energy needs. A very large fraction of domestic low cost conventional resources have already been found and are being used. Most of the remaining Canadian fossil fuel resources will prove expensive to recover and deliver. Massive investments will be required to develop these high cost resources to replace the gradually diminishing low cost conventional resources. The alternative is to import oil. The oil crisis of 1973 vividly demonstrated our vulnerability both as to supply and to cost if we were to be tied to imports to supply our domestic needs. While electrical energy can replace petroleum for only a relatively small number of uses, the incentive to do so whenever possible should be high.

4. The third major development has been the high inflation rates that have persisted over the last few years. This inflation has increased the capital cost component of electrical energy by roughly the same percentage for nuclear and fossil-fuelled generating stations. The effect of inflation on fuelling costs has been much greater for fossil-fuelled plants than for nuclear plants. The result is that over the life of a generating station, the cost of electrical energy from a nuclear station is less than that produced by most fossil fuelled stations.

5. The prospect of increasing dependence on nuclear power to supply our energy demands raises the question of ensuring an adequate supply of fuel. Like all non-renewable resources, uranium resources are not infinite. This was recognized in 1974 when the then Minister of Energy, Mines and Resources, Mr. D.S. Macdonald issued a statement on uranium export policy. Under this policy, sufficient uranium must be reserved to provide a thirty-year supply for all nuclear power stations in operation or planned to come into operation within the succeeding ten years. While there is ground for optimism concerning future discoveries of new uranium deposits in Canada, currently known resources are sufficient to provide a thirty-year supply of fuel for reactors expected to come into operation only until about 1990. This fact underlines the increasing importance of undertaking major R and D programs whose objective is to increase the efficiency of utilization of our uranium resources and to develop the technology required to introduce fuel cycles based on the use of thorium. These fuel cycles all require

the recycle of fissile material extracted from irradiated fuel. Although the concepts of the processes involved are reasonably well known, it is estimated that about twenty-five years will be required to reduce these concepts to industrial practice.

#### Isotopes

6. The world use of radioisotopes has continued to expand since 1968. This growth is expected to continue in the foreseeable future. Since the principal medical and industrial applications are all influenced by changing technical and economic factors, it is difficult to quantify future prospects for individual nuclides or individual applications.

7. AECL - Commercial Products serves three discrete domestic and world markets for radioisotopes, radiation sources and related products and services. The following briefly summarizes developments since 1968 and reviews prospects for the future.

#### Medical Radioisotopes

8. The use of radioisotopes in medical diagnosis and therapy has increased at an average rate of 20% per annum through the period and is expected to continue to do so. At the present time, it is estimated that one out of every four patients admitted to hospital in the western world received treatment involving the use of radioisotopes.

9. The predominant nuclide at present is molybdenum-99. In its final form, it is supplied to hospitals sealed in "Moly Generators" from which the short-lived technetium-99 daughter can be conveniently tapped for use in a variety of diagnostic procedures. Molybdenum-99 now accounts for 60% of the value of all radioisotopes shipped by Commercial Products.



10. Future demand will be for organ-specific radioisotopes with shorter half-lives and hence correspondingly reduced body residence times. Some of these isotopes cannot be produced in nuclear reactors but are obtainable from particle accelerators. With the TRIUMF facility, Canada possesses a powerful means of producing such isotopes. Commercial Products is currently negotiating with TRIUMF to gain access to facilities which will enable it to add cyclotron products to its current range of reactor products.

#### Industrial Radiation

11. The use of cobalt-60 as a source of gamma radiation in industrial processing has continued to expand, however the principal application has been in the sterilization of medical disposable products. To date, Commercial Products has sold a total of 42 production irradiation facilities in 22 countries for this purpose, containing a total of 12.5 Megacuries of cobalt-60.

12. It is anticipated that the medical products sterilization market will continue to expand throughout the world. Other applications envisaged a few years ago - such as the radiation induction of synthetic resin polymerization and the use of cobalt-60 in energy sources - do not currently offer good prospects for commercial use. On the other hand, the use of gamma radiation in food preservation continues to attract interest in many countries due to the rapid rise in the cost of food production, processing and distribution systems coupled with population increases and food shortages in many areas. Interest continues also in the use of radiation in the treatment of sewage. The successful commercial application of radiation in either food preservation or waste treatment will increase the market for radiation facilities by several orders of magnitude. Some of the installations

required for these applications would be of such large size that accelerators would probably provide a more economic source of radiation than cobalt-60. The accelerator research, design and manufacturing resources which AECL possesses at Chalk River and Commercial Products could readily be deployed to meet such a requirement.

#### Radiation Therapy

13. Radiation continues to be the principal means of treating deep-seated cancerous tumours and its use has increased throughout the world, particularly in the developing countries which are rapidly acquiring the needed resources of funds and trained staff.

14. With the introduction in recent years of linear accelerators, radiotherapists have available devices capable of producing a wide range of photon and electron energies which offer advantages in dealing with the problem of treating specific lesions. Commercial Products sale of cobalt units has declined but is expected to stabilize for the foreseeable future at about 50 units a year. These will be supplemented by the range of linear accelerators which has recently been introduced.

15. The demands of radiotherapists for greater precision of treatment, for means of verifying treatment actually applied by technical staff, and for means of producing automatic records of treatment for the patient's file has led to the introduction by Commercial Products of computerized teletherapy units and complex ancillary treatment - planning devices and systems.

16. In responding to these needs, Commercial Products retains its position as one of the leading suppliers to the teletherapy market throughout the world. Sales of cobalt units, linear accelerators, ancillary devices and systems are expected to double within the next four years.

Heavy Water

17. Heavy water is basic to the CANDU system. The bulk of the heavy water for the early phase of the Canadian nuclear power program was obtained from the United States, although lesser quantities were obtained from other countries including the USSR.
18. In 1963 it was decided to produce heavy water in Canada. The basic U.S. patents were available to Canada and that country was extremely helpful to Canada in the launching of this new business.
19. The first venture, the Glace Bay plant of Deuterium of Canada Limited, was never brought into production.
20. The first successful plant was the 50-kilogram-per-hour Port Hawkesbury plant of Canadian General Electric Company Limited. Production commenced in 1970. Success did not come quickly but production steadily increased until 1974, when the plant operated at an annual capacity factor of 75 per cent producing about 300 megagrams.
21. The second plant was the 100-kg-per-hour Bruce heavy water plant built by AECL and subsequently sold to Ontario Hydro. This plant produced its first heavy water in 1973 and in 1974, its first full year of operation, produced nearly 700 megagrams, corresponding to an annual capacity factor of about 75 per cent.
22. Atomic Energy of Canada Limited has built a new 50-kg-per-hour plant on the site of the original Deuterium of Canada plant at Glace Bay. It is scheduled to be in full operation next year.
23. In addition, AECL is building a 100-kg-per-hour unit at La Prade, adjacent to Hydro-Quebec's Gentilly site.
24. Ontario Hydro is tripling the size of the Bruce heavy water plant and is planning a fourth 100-kg-per-hour unit for the same site, plus another 400-kg-per-hour plant on a new site.
25. All these plants employ a hydrogen sulphide/water exchange process to increase deuterium (heavy hydrogen) concentration in



the water from the approximately 145 p.p.m. found in natural water to 30 per cent and vacuum distillation of the enriched water to produce material with a deuterium concentration of 99.75 per cent. The design of the Glace Bay and La Prade plants differs in detail from that of the proven Port Hawkesbury and Bruce plants and a measure of their performance is awaited to assess properly total Canadian production capacity. Assuming they are as successful as the present plants, by the early 1980s Canada will have enough heavy water production to supply 3000 megawatts of new nuclear-electric generating capacity a year.

26. Atomic Energy of Canada Limited and Ontario Hydro are spending about \$8 million a year on research and development to overcome operating problems, improve plant performance and design, and discover better ways to extract deuterium from water and other sources of hydrogen.

STATUTORY FUNCTIONS AND POWERS

The member of the Privy Council designated by the Governor in Council as the Minister for the purposes of the Atomic Energy Control Act is the Minister of Energy, Mines and Resources, the Honourable A.W. Gillespie.

ROLE AND OBJECTIVES

1. AECL is now responsible for the design, construction and operation of heavy water production plants. This role involves extensive co-operation with industry and utilities.

2. AECL is responsible for supplying radioisotopes and special equipment for using these isotopes, to Canadian and foreign markets. Over a period of time, Commercial Products has modified its functional organization in order to respond more effectively to the particular needs of these different markets. Nevertheless, difficulties continued to be encountered in the use of a traditional functional organization in handling a large variety of products utilizing different technologies and in serving diverse markets with different characteristics.

In January 1974, it was decided to restructure and reform the operation divisions and branches of Commercial Products to form three product groups, each possessing the resources needed to respond independently to its particular market. In the case of isotope products, the group acquired its own marketing, product development and production resources. In the case of industrial products, the group acquired its own marketing, product development and design resources as well as control of the cobalt production facilities. The largest group -- medical products -- acquired its own marketing, product development and design facilities as well as the equipment manufacturing plant. Since it was not practical or efficient to divide the cobalt production facilities or the equipment manufacturing plant, the industrial products group supplies cobalt products to the medical products group and the medical products group provides an equipment manufacturing service to the industrial products group.



The new product organization offers a number of advantages. It enables each of the product groups, as far as is practically possible, to focus its marketing, product development and product improvement resources more effectively in meeting the requirements of its particular market and in maintaining its competitive position. Each group operates with a separate profit and loss statement. This facilitates analysis of individual group performance and assists in short and longer term profit planning.

The three principal markets which Commercial Products serves have matured and stabilized. Each has acquired significantly different characteristics in terms of buying habits of customers, in terms of principal competing suppliers and in terms of the nature of competition in both pricing and product development and improvement. The size of each of these markets in Canada is relatively small and Commercial Products exports over 90% of its output of goods and services. In 1975/6, total sales revenues were nearly \$16 million.

In the case of the isotope market, principal customers are a small number of large pharmaceutical companies which purchase isotopes in bulk and further process them to secondary products which they distribute to hospitals directly. These companies normally purchase their bulk isotopes on an annual contract basis calling for tenders from a limited number of suppliers, of which Commercial Products is one.

In the industrial market, customers are a number of organizations of various sizes which manufacture a variety of disposable medical products required by hospitals. They utilize the industrial radiation facilities developed and produced by companies such as Commercial Products for the sterilization of their products.

In the case of the medical market, the products consist of therapeutic devices for cancer treatment utilizing cobalt-60 or linear accelerators as well as a variety of ancillary devices to facilitate treatment and treatment planning. These products are sold directly to hospitals. However, unlike the isotope and industrial products markets, the bulk of Commercial Products' business is obtained throughout the world via agents who are responsible for sales and product service. These agents are supported by Commercial Products' marketing and servicing departments.

STRUCTURE AND ORGANIZATION

1. AECL's Board of Directors consists\* of a Chairman and eleven Directors.

R. Campbell, Chairman of the Board  
Atomic Energy of Canada Limited

J.S. Foster, President  
Atomic Energy of Canada Limited

D.A. Golden, President  
Telesat Canada

Professor H.G. Thode  
Department of Chemistry  
McMaster University

H.M. Caron, C.A.  
Clarkson, Gordon & Company

Professor F. Bonenfant  
Department of Physics  
Laval University

Professor N.E. Henderson  
Department of Biology  
University of Calgary

A.J. O'Connor, General Manager  
New Brunswick Electric Power Commission

H.W. Macdonnell, Q.C.  
McCarthy & McCarthy, Barristers & Solicitors

R.B. Taylor, Chairman  
Ontario Hydro

G.M. MacNabb, Deputy Minister  
Energy, Mines & Resources

T.K. Shoyama, Deputy Minister  
Department of Finance

2. Meetings of the Board are held four or five times a year with an Executive Committee consisting of R. Campbell, J.S. Foster, D.A. Golden, H.G. Thode, G.M. MacNabb and T.K. Shoyama meeting every four to six weeks.

3. A number of senior staff members have retired in recent years. Dr. J.L. Gray retired as President to be succeeded by Dr. J.S. Foster. Dr. W.B. Lewis retired as Senior Vice-President, Science. Vice-Presidents R.F. Errington (Commercial Products), D. Watson (Administration) and L.R. Haywood (Heavy Water Projects) also retired.

\* as at date of printing.



4. A Heavy Water Projects office has been established in Ottawa. This Office is responsible for the Port Hawkesbury Heavy Water Plant, the design, construction and subsequent operation of the La Prade Heavy Water Plant, the rehabilitation and subsequent operation of the Glace Bay Heavy Water Plant and management of the heavy water supply and demand program.

5. With the successful completion of construction of the Nelson River D.C. transmission line in Manitoba the Power Projects office in Winnipeg responsible for this work has been closed.

6. A Montreal office, an arm of Power Projects, has been established to assume prime responsibility for AECL's role in the Hydro-Quebec nuclear program.

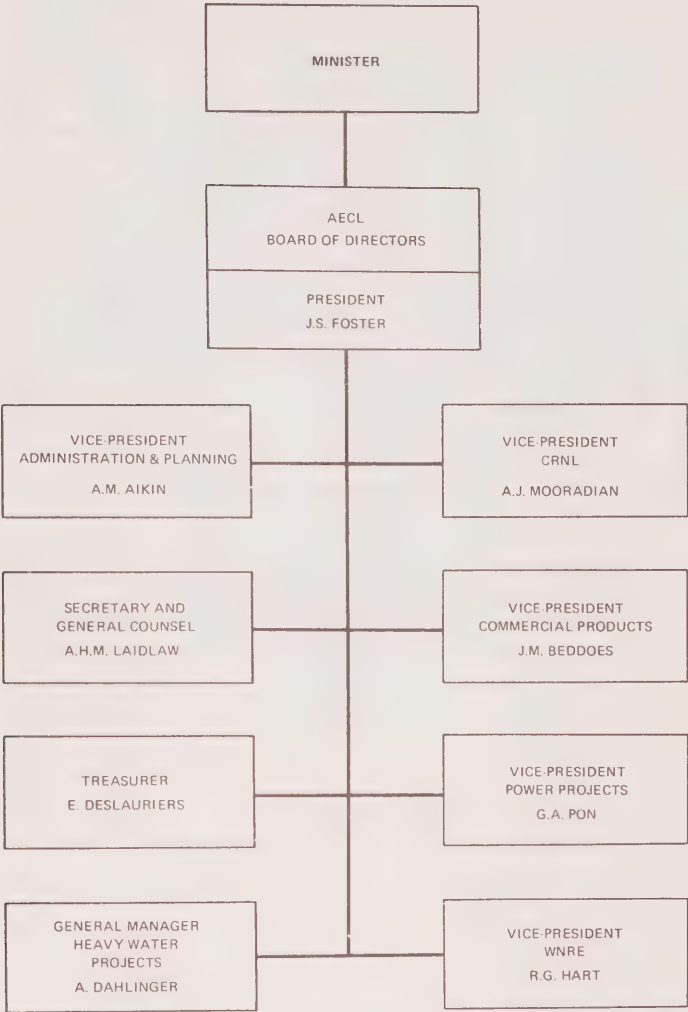
7. The basic organization chart of AECL is shown in Table 5A. The organization of Head Office and other AECL sites is shown in Tables 5B, C, D, E, F and G.

8. The number and distribution by organization and category of AECL employees as of 31 December 1975 were as follows:

	<u>Prof.</u>	<u>Tech.</u>	<u>Admin.</u>	<u>Hr. Rate</u>	<u>Totals</u>
Head Office	31	-	67	-	98
CRNL	476	552	392	911	2331
WNRE	180	221	165	230	796
C.P.	115	133	139	234	621
P.P.	467	486	299	-	1252
H.W.P.	<u>92</u>	<u>39</u>	<u>174</u>	<u>283</u>	<u>588</u>
TOTALS	1361	1431	1236	1658	5686

Appendix 5

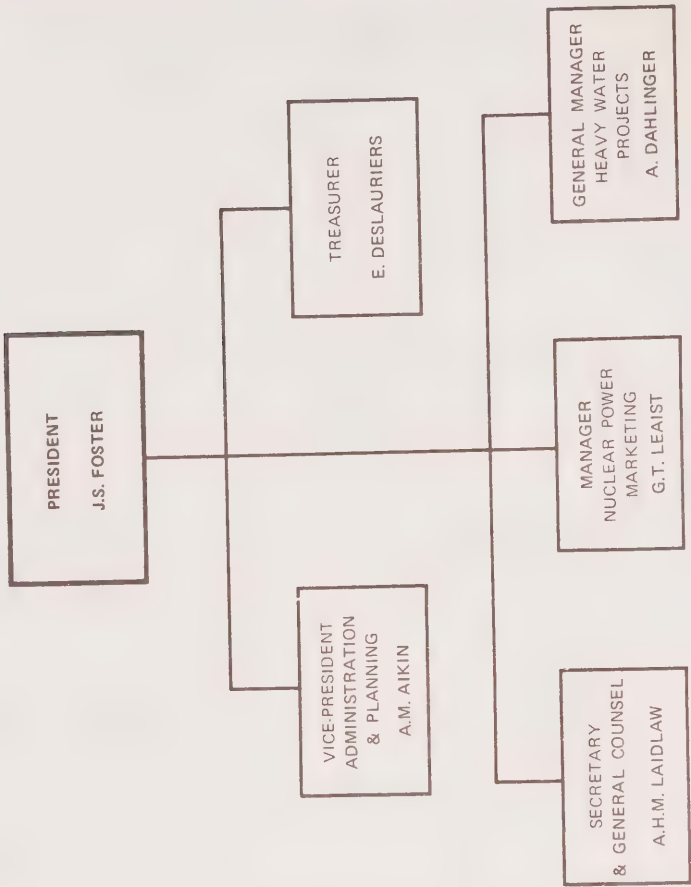
ATOMIC ENERGY OF CANADA LIMITED  
ORGANIZATION



OCTOBER 1975

TABLE 5A

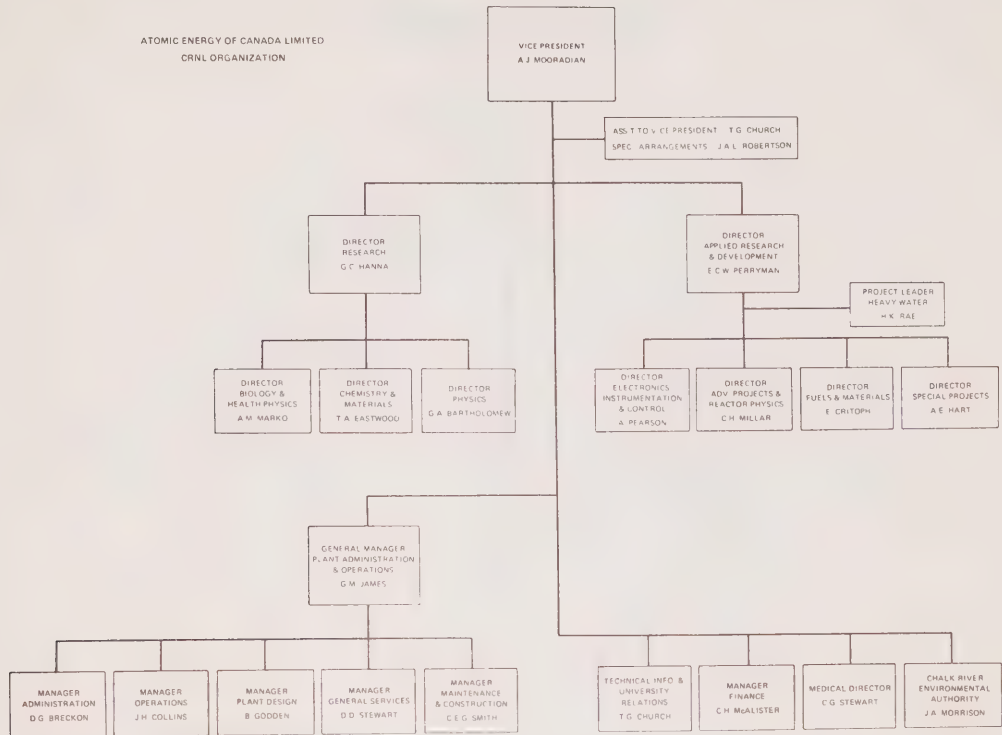
ATOMIC ENERGY OF CANADA LIMITED  
HEAD OFFICE ORGANIZATION



OCTOBER 1975

TABLE 58





APPENDIX 5

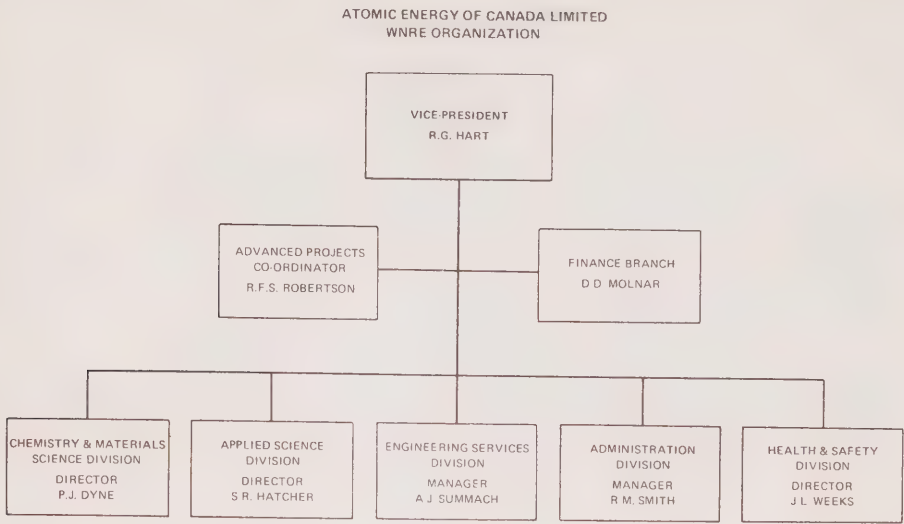
TABLE 5

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graph TD
    VP["VICE-PRESIDENT  
J.M. BEDDOES"]
    MA["MANAGER  
ADMINISTRATION  
L.R. MacDonald"]
    MF["MANAGER  
FINANCE  
H.A. MORRISON"]
    MP["MANAGER  
MEDICAL PRODUCTS  
H.G. GAY"]
    MIP["MANAGER  
ISOTOPE PRODUCTS  
A.B. LILLIE"]
    MIP2["MANAGER  
INDUSTRIAL PRODUCTS  
J.W. ANSTEE"]
    MQA["MANAGER  
PRODUCT QUALITY ASSURANCE  
H.M.F. WARLAND"]
    DSP["DIRECTOR  
SPECIAL PROGRAMS  
E.K. COLTAS"]

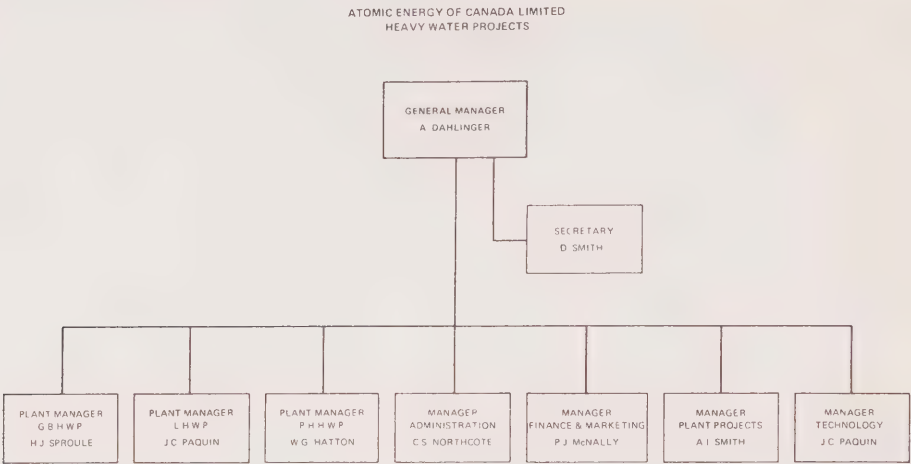
    VP --- MA
    VP --- MF
    VP --- MP
    VP --- MIP
    VP --- MIP2
    VP --- MQA
    VP --- DSP
  
```

TABLE 5D



OCTOBER 1975

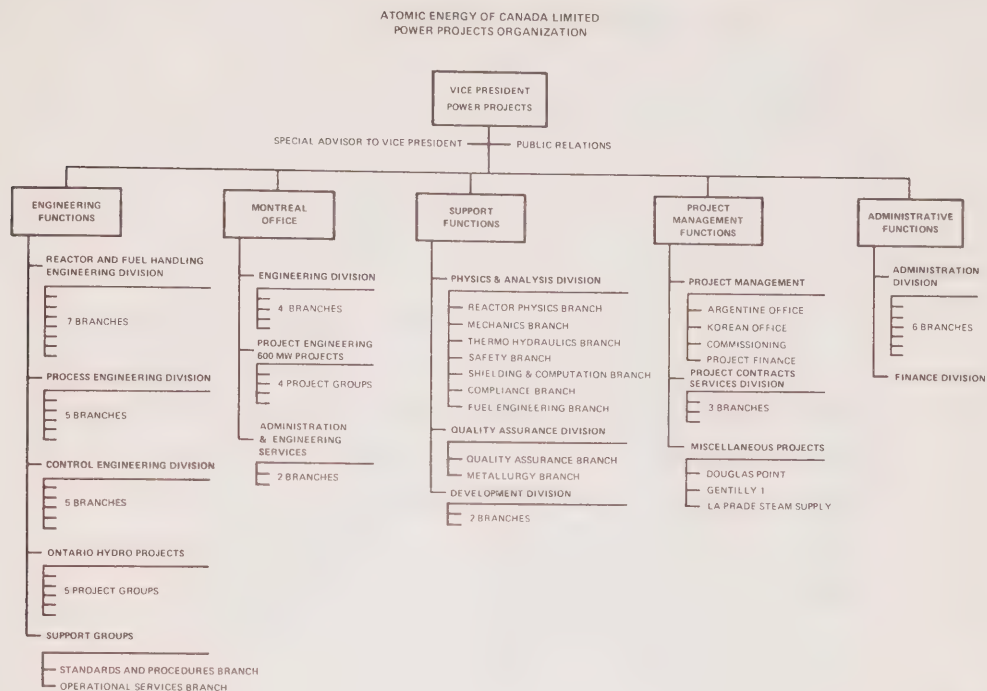
TABLE 5E



J.-M. CAYER, ACTING

TABLE M





AECL'S RELATIONS WITH OTHER ORGANIZATIONSWith Other Federal Agencies

1. The President of AECL is no longer a member of the Atomic Energy Control Board.
2. AECL has participated in an interdepartmental Panel on Energy R&D.
3. Co-operation with the National Research Council has continued in several subjects and at various levels. Both agencies have contributed to developing a proposed Canadian program for fusion R&D. It was agreed that NRC is the logical lead agency for the initial research phase prior to a major commitment to develop practical fusion reactors: AECL is the logical agency to select and execute a Canadian fusion project, if and when the prospects warrant it.

With Industry

4. AECL has continued to encourage participation by Canadian industry in Canada's nuclear programme. In the case of nuclear power this has been done by combining AECL's capabilities with those of industry to meet the common objective of economic nuclear power.

5. AECL's record of cooperation with industry has been good. The results are illustrated by the ordered growth of the Canadian nuclear industry from an engineering and manufacturing worth of \$67 million in 1965 to \$536 million in 1975. Converting these values to constant dollars shows an increase in the engineering and industrial effort during the decade by a factor greater than 4. These figures include the engineering and industrial costs of the complete nuclear power generating station (including fuel and heavy water) and the heavy water plants. The figures do not include items unrelated to Canadian industry such as costs of commissioning, administration, financing, or items purchased outside of Canada. Currently the Canadian content in manufactured materials and components in the nuclear system of a power generating station represents about 80% of the total value. One of AECL's objectives is to increase this contribution, and, at the same time, upgrade Canadian industry to meet the increasing quality standards demanded in nuclear applications.

6. To accomplish this objective, AECL continues to employ the following methods for industrial cooperation and transfer of technology:

- (a) research and development contracts to industry;
- (b) professional and engineering services contracts to industrial and engineering firms;

Appendix 6

- (c) technical reports to industry covering the R&D work done by and for AECL;
- (d) technical symposia with active industrial participation;
- (e) technical committees with industrial representation;
- (f) attachment of industrial staff to AECL.

7. An effective means of assisting industry and improving their technical capabilities is through AECL research and development contracts. AECL's main contribution in nuclear R&D within its own laboratories is basic research and applied research. In cases where industrial capabilities in the private sector are limited, AECL development is usually carried to the stage where technical feasibility and economic viability of the product or process can be demonstrated. Continued development and exploitation is required to reach the stage where economic and social benefits materialize. Exploitation is that stage of R&D which usually requires the greatest effort both in terms of manpower and capital. Exploitation is the stage at which an industry with limited R&D capability can make the most meaningful R&D contribution. As the level of competence of an industrial organization increases, a greater share of R&D responsibilities can be contracted to it. Using this type of arrangement AECL issues contracts to Canadian industry as an incentive to participate in the nuclear R&D process, and also to enhance industrial capabilities in the nuclear field. In the 1975-76 fiscal year it is estimated that these contracts to industry will total \$6.0 million. This funding covers about 90 contracts and involves about 30 Canadian companies. These cooperative R&D programmes between AECL and industry have been based on a unified effort



with a common goal. A desirable feature of such a cooperative effort is that the AECL research and development staff have full responsibility and authority in administering the contract work. Since the same staff are also engaged within AECL on the same program, a high level of technical supervision of the contract work is maintained. This type of arrangement makes it much easier to introduce and initiate R&D work in companies with very limited R&D capability; and it also provides a flexible division of responsibilities between industry and AECL in accordance with changing industrial capabilities.

8. A number of years ago it was apparent that the nuclear design function for nuclear power stations should be consolidated as there was insufficient demand to support more than one group. AECL assumed the responsibility to ensure that a Canadian design capability existed which would meet the needs of the electrical utilities. The policy has been to use as much engineering assistance from commercial professionals and consultants as possible. In some projects the amount of AECL engineering manpower effort is less than 50 percent of the total. In the fiscal year 1975-76 contracts with consultant and engineering firms for technical services were awarded to 12 companies and are estimated to total 7.0 million dollars.

9. Technology transfer is a very important factor in the development of the Canadian nuclear power programme, and AECL has contributed a great deal of effort to fulfill its responsibilities. In addition to the contracting arrangements (both for R&D and professional services) technology transfer to industry is being accomplished by reports, symposia, technical committees and attachments of industrial personnel to AECL. Technical reports are issued, made available to industry, covering all phases of AECL research and development. Technical symposia are held with active participation by

industry to discuss topics such as changing requirements for nuclear products, or the reliability of materials and equipment for nuclear applications. Industrial representation is sought, as early as possible, on committees dealing with problems which will eventually involve Canadian industry on a commercial basis. For example, AECL is investigating the future use of nuclear fuels containing plutonium. The manufacture of mixed fuels of  $(U, Pu)O_2$  is much more complex than the fabrication of natural  $UO_2$  fuels which are used today. A committee composed of industrial and AECL representatives completed a conceptual assessment of the fabrication processes, plant design, and the estimated costs for commercial fabrication of the mixed fuel.

10. Experience has shown that a most satisfactory method of transferring capability from one organization to another is through attached staff. Currently there are 32 professionals and senior technicians from Canadian industrial and engineering firms attached to AECL. Also attached are about 25 professionals from the Canadian power utilities. Such attachments are mutually beneficial because they result in an effective combination of R&D capabilities with industrial experience (manufacturing and economic) for the development of nuclear components. It should also be noted that many AECL employees, after gaining a number of years of experience, are hired by Canadian industry and the power utilities. This practice is not discouraged and it has resulted in a significant and effective transfer of technology to industry.

11. In addition to the normal design services, AECL often cooperates with industry on a straight commercial basis. For example, the manufacture of some types of nuclear fuels have a very limited production or are made on a "once-off" basis. Special equipment which was fabricated during the development of such fuels often can be used for the required, limited, manufacture. In such cases AECL rents the equipment to the manufacturer. The power utilities often require consulting service with respect to the nuclear systems in their generating plants. AECL is able to provide such consulting service to assist the utilities in overcoming their problems.

12. In summary it can be concluded that AECL has evolved very effective cooperative arrangements with Canadian industry in developing the Canadian nuclear power programme.

With Educational Institutions

13. There has been no significant change in our policy regarding relations with educational institutions. The following specific events have occurred since the last report.

- (a) The volume and value of R&D contracts with universities has decreased somewhat, primarily due to a shortage of funds. Current totals are about \$500,000 per annum, with 15 different universities involved.
- (b) The prototype SLOWPOKE reactor was designed and built at CRNL to provide, at reasonable cost, a more intense source of neutrons than is practicable by radioactive isotope methods. After extensive testing it was loaned to the University of Toronto in 1971 to evaluate its usefulness, safety and operational reliability in a variety of research and teaching projects at the University and associated hospitals. The reactor has become firmly integrated into the university community and in the fourth year since the start of operation operated 2600 hours and performed 6800 separate irradiations to meet the needs of more than 50 users. The university, with the assistance of an AECS capital grant, has agreed to purchase a commercial model of SLOWPOKE which will be better able to meet the increasing demands placed on the prototype.



As a direct result of the excellent experience at Toronto it is expected that three other Canadian universities will purchase commercial SLOWPOKES in the next two years.

- (c) The industrial internship program, under which qualified engineering students spend up to five months working at an AECL site in partial fulfillment of the requirements for a graduate degree, has been very successful and has gradually expanded as staff and facilities permit.

With Atomic Energy Programmes Outside Canada

14. As the Canadian programme has matured, collaboration on a bilateral basis with other national atomic energy agencies has increased, and participation multilaterally in such international organizations as the International Atomic Energy Agency and organizations for economic cooperation and development has become an important part of that programme.

15. The dimension of these activities was broadened with the signing in November 1974 by Canada and OECD member countries of an agreement establishing an International Energy Programme. The agreement is implemented through an International Energy Agency and has among its provisions undertakings whereby participating countries will work cooperatively on conservation of energy, accelerated development of alternative sources of energy, research and development in the energy field and on uranium enrichment.

16. It is indeed fortunate that at this time, when nations are mindful of the need to work together in the development of low-cost energy through international collaboration, Canada with other like-minded nations should be so well placed to make a positive contribution in the field of nuclear power technology. From the vantage point of the 70's, such arrangements may be seen as a model for collaboration in other energy fields and may similarly add new dimension to the world's energy resources.

General

17. AECL has fully participated in the activities of the Canadian Nuclear Association, providing many of the speakers for Annual Meetings, Topical Meetings and Seminars. AECL employees continue to contribute to other organizations relevant to atomic energy, at the local, provincial, national, regional and international levels.

ORGANIZATIONAL POLICIES

1. There have been no major changes in AECL's organizational policies, other than those necessitated by the establishment of Heavy Water Projects (See Appendix 5). Internal changes within Commercial Products were mentioned in Appendix 4 in discussing their Role and Objectives.
2. Following the retirement of the Senior Vice-President, Science, the Power Reactor Development Program Evaluation Committee has been chaired by the Vice-President, Administration & Planning, A.M. Aikin.
3. AECL's deliberate policy of maintaining flexibility for change of emphasis between projects has proved invaluable in the commercialization of both power reactors and heavy water plants. This response capability has allowed potential problems to be identified and solved before their effects became serious. Another policy, that of effective collaboration with utilities and the Canadian nuclear industry has contributed to the speed with which such solutions to such problems have been introduced into service.



PERSONNEL POLICIES

1. AECL's personnel policies continue to prove satisfactory and have remained largely unchanged.
2. Many of our new employees have had previous experience elsewhere, as was noted nine years ago, but we are now taking in a higher proportion of new graduates at the bachelor level.
3. Largely as a result of inflation, individual research workers may now advance through grades to a salary of \$30,000 per annum, or more, without having to accept administrative responsibilities.
4. AECL staff of sites near large population centres are able to further their education through part-time courses offered by universities and colleges. For the more remote sites AECL has been successful in arranging for certain universities and colleges to offer on-site credit courses where there is sufficient demand.
5. There has been an increase in the percentage of AECL professionals directly engaged in R&D who have engineering degrees, with 52 percent now so qualified.
6. Increased emphasis has been accorded to management-employee relations, largely through regular consultative meetings between management and representatives of the staff societies or unions.

DISTRIBUTION OF ACTIVITIES

1. AECL has four principal operating establishments, three of which are in Ontario and one in Manitoba. There is also an office in Montreal which is being expanded and has prime responsibility for AECL's role in the Hydro-Quebec nuclear program. With the completion of construction and successful operation of the Nelson River transmission line the Power Project office in Winnipeg responsible for this work has been closed. A Heavy Water Projects office has been established in Ottawa to be responsible for the design, construction, operation and maintenance of AECL heavy water plants and to manage the heavy water supply and demand program. The three AECL heavy water plants are located at Port Hawkesbury and Glace Bay, Nova Scotia and at La Prade, P.Q.

PERSONNEL STATISTICS

1. The personnel strength of AECL sites as of 1 December 1975 is given in Appendix 5.

2. Those in AECL who have management and senior administrative responsibilities have professional backgrounds and are listed as professional staff. The number of professionals who are primarily engaged in administrative and management duties are:

Head Office	-	20
CRNL	-	34
CP	-	18
HWP	-	13
PP	-	20
WNRE	-	<u>18</u>
		123

3. In the research and development groups it is common practice to have a professional reporting to the director in a staff capacity to handle administrative matters of the group such as personnel, purchasing, budget preparation and control, thereby allowing the group director to concentrate on the technical direction of his programme.

4. Data on the educational backgrounds of AECL professional staff and other personnel statistics are given in Tables 10A and 10B. In Tables 10A and 10B data on only those professionals who are primarily associated with scientific activities have been recorded since these are considered to be more relevant.

5. The distribution of professional staff when comparing the number of working years since graduation with the number of years employed by AECL has not changed significantly since 1968.

6. The number of AECL professionals able to operate effectively in Canada's two official languages remains low but has increased significantly in recent years. It is expected that the number will continue to rise steadily as application of the Company's official languages policy is developed in line with the government's overall programme.

7. The experience and background of AECL professional staff are quite varied. While Table 10C shows that a high percentage have worked elsewhere since graduation, it is Company policy to increase significantly the proportion of new graduates being hired in the light of an increase in the number of retirements.

8. There has been no significant change in percentage turn over of AECL professional staff in each degree category since 1968.

9. The approximate numbers of university students given summer employment in technical activities by AECL in 1970-75 were:

	<u>CRNL</u>	<u>CP</u>	<u>PP</u>	<u>WNRE</u>	<u>TOTAL</u>
1970	42	-	17*	36	95
1971	49	-	20*	36	105
1972	54	-	16*	35	105
1973	66	1	13*	41	121
1974	64	2	18	43	127
1975	75	2	22	22	121

AECL also supports the co-operative training programmes of the Universities of Waterloo, Sherbrooke, Memorial and Saskatchewan (Regina). These programmes offer work-terms of four months in industry, alternating with four-month periods of study at the University.

\* approximate



10. Employees of AECL have come under federal labour relations legislation (currently Canada Labour Code Part V) since 1952, when AECL was incorporated. All hourly-rate workers and a substantial proportion of the technical and supporting staff are represented by unions and are under collective agreements. Some 25 different local unions are currently recognized as bargaining agents for specific groupings of AECL employees and there is at least one union at each AECL site other than Head Office and the Heavy Water Projects Office in Ottawa. At Power Projects non-management professional employees are unionized, while there are non-unionized societies of professional employees at CRNL, WNRE and Commercial Products with which the Company has regular dealings.

11. Salary scales for all non-unionized staff are reviewed annually and adjusted as appropriate to ensure that they are competitive. Normally all adjustments are announced before changes become effective--in other words there is no back-dating of salary scale increases. In determining adjustments to the professional scales, the primary criteria are the salaries paid to scientists and engineers by the major Canadian industries and Canadian universities and the salaries paid to those doing comparable work in other federal government agencies.

12. Merit increases for most AECL professional staff are determined by site management within a "merit package" allotted to each site each year based on the composition of the professional employees at the site.

Table 10A

AVERAGE AGE OF AECL PROFESSIONAL STAFF  
BY HIGHEST DEGREE

---

	<u>Bachelor</u>	<u>Master</u>	<u>Ph.D.</u>
CRNL	42	37	38
PP	38	38	36
WNRE	39	33	35
<u>Distribution</u>			
CRNL	7	52	139
PP	30	29	11
WNRE	21	20	54

Table 10B

AECL PROFESSIONAL STAFF BY COUNTRY  
IN WHICH UNIVERSITY DEGREE TAKEN

	I			II			III		
Country & Degree Category	Country of Birth			Country in which Secondary Education is taken			Country in which University Degree is taken		
	CRNL	WNRE	PP	CRNL	WNRE	PP	CRNL	WNRE	PP
<u>CANADA</u>	-	-	-	-	-	-			
1) Bachelor							39	15	20
2) Masters							44	13	19
3) Ph.D.							85	29	16
							<u>168</u>	<u>57</u>	<u>55</u>
<u>U.K.</u>	-	-	-	-	-	-			
1) Bachelor							31	4	11
2) Masters							9	5	5
3) Ph.D.							48	18	2
							<u>88</u>	<u>27</u>	<u>18</u>
<u>U.S.A.</u>	-	-	-	-	-	-			
1) Bachelor							1		
2) Masters							6	2	4
3) Ph.D.							23	5	7
							<u>30</u>	<u>7</u>	<u>11</u>
<u>OTHERS</u>	-	-	-	-	-	-			
1) Bachelor									6
2) Masters									3
3) Ph.D.							10	5	1
							<u>10</u>	<u>5</u>	<u>10</u>
TOTAL							296	96	94

## Appendix 10

Table 10C

WORKING EXPERIENCE OF AECL PROFESSIONAL STAFF

Percentage of staff who have had outside experience before  
joining AECL:

<u>CRNL</u>	<u>WNRE</u>	<u>PP</u>
76.5%	79%	95%



EXPENDITURES

As agreed by Senator Lamontagne information on AECL's research and development expenditures has been supplied to the Committee by the Ministry of State for Science & Technology.

RESEARCH POLICIES

The underlying philosophies that dictate which research projects should be undertaken and what direction should be given to these projects have been so successful that no changes have been necessary.

The nature of many projects has changed, however, as increased operating experience with nuclear power reactors has pointed out many problems that required the initiation of collaborative research and development projects. The entrance of AECL into heavy water production has also created a whole new area of work involved with improved operation of heavy water plants.

The administration of university and industrial contracts has not changed over the years, as our methods have proven to be successful and AECL continues to contract out research and development work on specific components of its programs. Typical examples of research contracts to Canadian universities in 1974 are:

- (1) Two Phase Flow Studies - Chem Eng. - Calgary
- (2) Investigation of Organic Contaminants in G-S Heavy Water Process - Chemistry - Dalhousie
- (3) Effect of Pulsating Axial Flow on Fuel Element Vibration - Mech. Eng. - McGill
- (4) Ecology of Shallow Water Communities - Biology - Quebec
- (5) Proton Beam Experiments - Physics - Simon Fraser
- (6) Geologic Storage of Radioactive Waste - Earth Sciences - Quebec
- (7) High Temperature Deformation of Zirconium-Oxygen Alloys - Met. Eng. - Manitoba

The annual expenditures on university contracts ranged from a few thousand up to \$56,000 per contract.

Applied research and development continues to be contracted to industrial firms in the Canadian private sector to utilize their manufacturing capabilities, to introduce new technology and to enable them to meet the increasing demands for components and services in the rapidly expanding nuclear field.

During 1974-75 the company spent nearly \$7 million on development contracts with 35 different Canadian firms and purchased more than \$8 million in professional and special services involving nuclear technology. Additionally, 43 people from private companies were attached to AECL sites for training in areas of technology pertinent to their commercial interests.

These industrial contracts cover a wide range of topics, examples are:

- (a) Study of foaming in heavy water process towers.
- (b) Effects of impurities in process streams and the economics of the ammonia process for heavy water production.
- (c) Self-powered neutron flux detectors.
- (d) Thorium dioxide fuel pellets.
- (e) Bellows for stem seals in small valves.
- (f) Plutonium reprocessing.
- (g) A cold-working process for fabricating Zr-2.5 wt% Nb pressure tubes.
- (h) Stronger calandria tubes.
- (i) Fuel vibration.
- (j) Models of reactor behaviour during a loss-of-coolant accident.

AECL has also continued R&D contracts with the appropriate utilities operating AECL prototype or demonstration plants.

In addition, AECL continues to organize conferences and meetings where others can interact with the plans of the company. Recent examples are the meeting on the utilization of waste heat from nuclear power reactors and our participation in the Canadian Nuclear Association 1975 annual conference where our plans for spent fuel storage were aired.



RESEARCH OUTPUT

AECL continues to file patents in Canada and in a number of foreign countries. The number of new patents from 1968 to 1975 is given in the following table:

	1968	1969	1970	1971	1972	1973	1974	1975
Reactor and Misc. Applications - Initial Filings	21	17	7	10	8	6	17	21
Commercial Products Applications - Initial Filings	9	20	25	10	12	4	3	0

During the period 67-68 to 73-74 one patent produced almost \$3,000 in royalties. Total royalties received in this period amounted to approximately \$45,000, of which the company received approximately \$31,000. Fees to Canadian Patents & Development Limited and royalties to inventors account for the balance.

Active foreign exchanges have continued with Britain, U.S.A., Italy, Japan and the U.S.S.R. There have also been some additional activities. An exchange agreement between Commercial Products and Compagnie Generale de Radiologie, a French firm, is in effect on the production and marketing of medical therapy accelerators. An arrangement has been made with Sulzer Brothers Ltd. of Canada and Switzerland, for co-operation in further development of the hydrogen-amine heavy water production process. The latest Canada-UK exchange agreement provides for detailed collaboration on the CANDU reactor and the SGHWR. A licensing agreement is being arranged with an Italian partner for co-operation in the construction and marketing of CANDU power reactor stations. Most of these agreements involve patent exchanges.

AECL publishes a great many reports and papers each year based upon its research. These publications are listed in the AECL List of Publications which is now produced semi-annually with annual and 5 year cumulations. It is distributed to 449 centres

throughout the world.

Abstracts of all AECL publications and of all other Canadian literature in nuclear science are sent to the International Nuclear Information System and to Nuclear Science Abstracts. These systems each collect about 65,000 abstracts annually and in 1974 AECL submitted over 800 to each.

The details of AECL publications, both in the published AECL series and in the internal, restricted distribution series are given in the table below:

AECL Publications

	1969	1970	1971	1972	1973	1974
Published in journals	157	168	151	143	164	252
Proceedings of conferences	16	23	51	19	36	27
Published in AECL series	141	140	163	112	126	78
Unpublished reports	975	863	863	793	900	874

AECL contributes widely to conferences and particular support is given to the Canadian Nuclear Association annual conference. AECL was a major participant in the 1971 United Nations conference on the Peaceful Uses of Atomic Energy. In addition to published conference papers, AECL authors deliver 150 to 200 papers annually at conferences throughout the world.

AECL collects many thousands of documents as a result of technical agreements with other countries. These are stored in the library at CRNL which is the national depository for nuclear science literature.

The library at CRNL, because it is the national depository for nuclear information, distributes a great many documents. The following table gives the report and book loans at CRNL for 1969

to 1974 inclusive:

Library Loans						
	1969	1970	1971	1972	1973	1974
Books	10385	5326	6360	8109	9110	9199
Reports	22376	19116	20275	20316	22061	19522

As stated before, one of AECL's functions is to train people for the expansion of nuclear science and technology throughout Canada. The number of AECL scientists and engineers joining other organizations remains at previous levels. In addition to technological transfer to industry through R&D contracts and attached staff, a large and growing number of mutual visits by AECL and industrial staff fosters such transfer and the use of AECL's output.

The research and development output of the company has led to the successful completion and operation of the Pickering Nuclear Generating Station. Gentilly-1 has been operated and is currently being recommissioned after a long shutdown. Douglas Point is now operating very successfully and has been tied into the Bruce Heavy Water Plant. NPD was reconverted back to the pressurized water mode of coolant after having provided the required operating experience in the boiling water mode. The Bruce-A Generating Station is nearing completion and construction has started on six more reactors, namely at Pickering-B in Ontario, Gentilly in Quebec, and Point Lepreau in New Brunswick. Eight additional reactors are in the offing, for Bruce-B and Darlington Generating Stations.

Overseas, CANDU reactors are operating in Pakistan and India and construction has started on the Cordoba plant in Argentina and the Wolsung plant in Korea. A research reactor is operating successfully in Taiwan.

As a result of initial difficulties with heavy water production plants, AECL rapidly mounted a large multi-disciplinary effort to study problems and improve plant operation. This work has been successful and a significant industry has been established. Ontario Hydro is operating an 800 ton/year plant, that was originally built and commissioned by AECL, and has two similar plants under construction. AECL is now operating the former CGE plant at Port Hawkesbury and re-commissioning the plant at Glace Bay. A further AECL plant at La Prade is in the early stages of construction. Results of further improvements in tower tray design and plant reliability, now in progress, will make significant economic contributions.

The success of the CANDU power reactor industry and the heavy water industry must be attributed in part to the high quality of both long- and short-term on-going research and development that has taken place in AECL. Many firms in Canada are now successfully producing and marketing components and constructing reactor stations and heavy water plants because of this program. Part of this can also be attributed to the establishment of nuclear standards by the Canadian Standards Association. AECL plays a major role in this.

Research output has been particularly noticeable in solving the problems of D<sub>2</sub>O leakage, fuel failures, and the buildup of radiation fields at Douglas Point. At Pickering, fuel failures and cracked pressure tubes have been the major problems, and R&D has contributed materially to the resolution of these. The solutions to these problems have involved large multi-disciplinary teams consisting of staff from AECL sites, utilities and industry.

Teams are a part of AECL organization and the output of these teams is a major product of the company. Inter-disciplinary teams are working on:

- 1) pre-engineering and development on a 1250 MWe CANDU-PHW
- 2) design study of a 2000 MWe CANDU-PHW
- 3) improved fuel design for CANDU-PHW reactors
- 4) improved reactor channels
- 5) reactor physics
- 6) safety analysis of reactors and heavy water plants
- 7) waste management
- 8) environmental considerations of reactors and heavy water plants
- 9) equipment reliability for reactors and heavy water plants
- 10) decreased radiation exposures to operators
- 11) in-service inspection
- 12) corrosion and deposition in reactor circuits and heavy water plants
- 13) operating parameters in heavy water plants
- 14) process control and monitoring
- 15) studies on defects in materials
- 16) long-term solid state studies of ideal single-crystal material
- 17) advanced radiation detectors
- 18) nuclear and atomic data
- 19) theoretical nuclear analysis
- 20) laser applications
- 21) electronuclear breeding
- 22) advanced accelerator design
- 23) treatment simulators for patient radiotherapy treatment
- 24) treatment planning systems for computer customizing of patient radiotherapy treatment



- 25) on-line isotope separation
- 26) studies on a typical lake in the Canadian Shield
- 27) radiation damage and repair in living systems.

Many more teams exist and their structure is not always constant. People are added when needed and move to other projects when their work is done.

The research output may be an individual package rather than part of a larger system. A team has designed the highly successful SLOWPOKE reactor, a safe, low-power, automated research reactor. Another group has developed commercial gamma irradiators for medical product and food sterilization. A linear accelerator for radiotherapy use is now being marketed after development at CRNL and Commercial Products. The production and marketing of Molybdenum-99 has progressed to the point where AECL now supplies much of the world market for this "almost universal" isotope. New improved production techniques were developed at AECL to make this possible.

Many tools and facilities exist within AECL that aid in the creation of knowledge. Some recent additions to these facilities are:

- 1) twinning the test section of the U-1 loop in NRU
- 2) upgrading the MP tandem accelerator
- 3) a full scale test rig for liquid shutoff rods
- 4) a mobile pilot plant for the Girdler-Sulphide process of heavy water production
- 5) a pilot line for the fabrication of (Pu, U) oxide fuels
- 6) an on-line computer for analysis and control of in- and out-of-reactor loops

- 7) a CDC-6600 computer with a CDC-3300 acting as a foreman
- 8) rebuilding of the NRX and NRU research reactors
- 9) a QD<sup>3</sup> spectrometer for nuclear studies.

New facilities under consideration include such things as:

- 1) a superconducting cyclotron (See Appendix 14, A14,8b))
- 2) an 11.25 MW loop interconnected with the loop facilities at NRU and a 15 MW horizontal stand-alone facility for two phase heat transfer and safety-related experiments
- 3) the addition of a CYBER 175 computer to the existing CDC-6600, AECL's major scientific computing facility, essentially tripling its capacity
- 4) a radioactive waste treatment centre utilizing incineration, liquid concentration and bitumenization to achieve volume reduction and fixation.

The above lists are only examples to indicate the wide range of the research performed at AECL.

The scientific work of AECL has been recognized by the award of the following honours during the years 1968 to 1975:

- |   |                                   |
|---|-----------------------------------|
| - Companion of the Order of Canada 1969   | - J.L. Gray                       |
| - Special Award of the American Nuclear Society 1969                            | - A.G. Ward                       |
| - Canadian Association of Physicists Gold Medal for Achievement in Physics 1970 | - W.B. Lewis                      |
| - Royal Danish Academy of Sciences and Letters Elected a Foreign Member 1970    | - J.A. Davies                     |
| - Chemical Institute of Canada Fellows 1971                                     | - F. Brown<br>- D.H. Charlesworth |

Appendix 13

- |   |                                     |
|---|-------------------------------------|
| - Royal Society of Canada<br>Fellow 1971  | - J.A. Davies                       |
| - Engineering Institute of Canada<br>Angus Medal 1971   | - P.A. Ross-Ross                    |
| - Royal Society of Canada<br>Fellows 1972   | - A.J. Mooradian<br>- J.C.D. Milton |
| - Science Council of Canada<br>Associate Member 1972  | - A.J. Mooradian                    |
| - Association of Professional<br>Engineers of Ontario<br>Professional Engineer's Gold<br>Medal 1972 | - J.L. Gray                         |
| - Royal Society of London<br>Royal Medal 1972   | - W.B. Lewis                        |
| - Thirteenth International<br>Conference on Radiology<br>Gold Medal 1973                            | - C.G. Stewart                      |
| - Royal Society of Canada<br>Fellow 1973  | - E.C.W. Perryman                   |
| - Engineering Institute of<br>Canada<br>Angus Medal 1974  | - J.S. Nelles                       |
| - Royal Society of Canada<br>Fellow 1974  | - J.S. Foster                       |
| - Engineering Institute of<br>Canada<br>Fellow 1974   | - J.S. Foster                       |
| - Chemical Institute of Canada<br>Fellow 1974   | - D.R. Smith                        |
| - Health Physics Society<br>Ella E. Anderson Award 1975   | - R.V. Osborne                      |
| - Canadian Nuclear Association<br>W.B. Lewis Medal 1975   | - G.C. Laurence                     |
| - Engineering Alumni Association<br>University of Toronto<br>Meritorious Service Medal 1975         | - G.A. Pon                          |

R.M. Hutcheon and L.W. Funk are two of a group of six authors of a paper which won the Farrington Daniels award of the Association of American Physicists in Medicine. The award was presented in 1975 for the first time and was for the best paper published in "Medical Physics in the year prior to the presentation.

In addition a number of honorary university degrees were received by AECL researchers.

#### Appendix 13









FIRST SESSION—THIRTIETH PARLIAMENT  
1974-76

THE SENATE OF CANADA  
PROCEEDINGS OF THE  
SPECIAL COMMITTEE OF THE SENATE ON  
**SCIENCE POLICY**

The Honourable MAURICE LAMONTAGNE, P.C., *Chairman*

Issue No. 18

WEDNESDAY, AUGUST 11, 1976

**Eighteenth Proceedings on**  
**The Study of Canadian Government and**  
**other expenditures on scientific activities**  
**and matters related thereto.**

(Witnesses and appendix: See Minutes of Proceedings)



THE SPECIAL COMMITTEE OF THE  
SENATE ON SCIENCE POLICY

The Honourable Maurice Lamontagne, P.C., *Chairman*

The Honourable Donald Cameron, *Deputy Chairman*

and

The Honourable Senators:

Asselin	Hastings
Bélisle	Hicks
Bell	Lang
Blois	Manning
Bonnell	Neiman
Bourget	Riel
Buckwold	Robichaud
Carter	Rowe
Giguère	Stanbury
Godfrey	Thompson
Goldenberg	van Roggen
Grosart	Yuzyk
Haig	

27 Members

(Quorum 5)

# Order of Reference

Extract from the First Report of the Special Committee of the Senate on Science Policy, presented on July 10, 1975 and printed as an Appendix to the Minutes of the Proceedings of the Senate of that day, and adopted by the Senate on July 24, 1975:

"The Committee, therefore, recommends that it be authorized to consider and report on Canadian government and other expenditures on scientific activities and matters related thereto;

That the Committee have power to engage the services of such counsel and clerical personnel as may be necessary for the purpose of the inquiry;

That the Committee have power to send for persons, papers and records, to sit during adjournments of the Senate and to report from time to time; and

That the Committee be authorized to print such papers and evidence from day to day as may be ordered by the Committee."

Robert Fortier,  
*Clerk of the Senate.*

# Minutes of Proceedings

Wednesday, August 11, 1976.  
(28)

Pursuant to adjournement and notice the Special Committee of the Senate on Science Policy met this day at 2:33 p.m., the Chairman, the Honourable Senator Lamontagne, presiding.

*Present:* The Honourable Senators Bell, Buckwold, Godfrey, Lamontagne, Lang, Stanbury, and Yuzyk. (7)

*Present but not of the Committee:* The Honourable Senator Lapointe. (1)

*In attendance:* Mr. Philip J. Pocock, Director of Research, and Jacques Ostiguy, Chief of Administration.

The Committee resumed consideration of its Order of Reference dated July 24, 1975 relating to the study of Canadian Government and other expenditures on scientific activities and matters related thereto.

The following witnesses from the Department of Energy, Mines and Resources were heard:

Dr. J. D. Keys,  
Assistant Deputy Minister,  
Science and Technology;

Dr. Ron Niblett,  
Division of Geomagnetism,  
Earth Physics Branch.

On Motion by the Honourable Senator Bell it was *Agreed* that sections 2.1 to 2.8 inclusive of the brief presented to the Committee by the Department of Energy, Mines and Resources be printed as an appendix to this day's Minutes of Proceedings and Evidence. (*See Appendix No. "32"*)

The witnesses answered questions put to them by Members of the Committee.

At 5:35 p.m. the Committee adjourned until 9:30 a.m., Thursday, August 12, 1976.

ATTEST:

Patrick Savoie,  
*Clerk of the Committee.*

# The Special Committee of the Senate on Science Policy

## Evidence

Ottawa, Wednesday, August 11, 1976

The Special Committee of the Senate on Science Policy met this day at 2:33 p.m. to consider Canadian government and other expenditures on scientific activities and matters relating thereto.

**Senator Maurice Lamontagne** (*Chairman*) in the Chair.

**The Chairman:** Honourable senators, I want to welcome the Speaker of the Senate to our meeting this afternoon. I am sure that she will have a lot of questions to ask.

As chairman of the committee, I am pleased to welcome representatives of the Department of Energy, Mines and Resources, namely, Dr. J. D. Keys, Assistant Deputy Minister, Science and Technology, and Dr. Ron Niblett, Division of Geomagnetism, Earth Physics Branch.

The brief which has been sent to us, like several others, is rather voluminous, although I must say that, fortunately, it is less extensive than others.

**Senator Stanbury:** It is in smaller print!

**The Chairman:** We have a printing problem, so I wonder if we could avoid printing the four appendices. Is this information available elsewhere, more or less in the same form?

**Dr. J. D. Keys, Assistant Deputy Minister, Science and Technology, Department of Energy, Mines and Resources:** I am sure we can do that. We can certainly make it available if anybody wishes it.

**The Chairman:** What about other parts of the brief? What about the section on projects, for instance? This is just a kind of enumeration of projects that are being carried out by the department. Is that available?

**Dr. Keys:** We could make it available, but in order to do so in that format we would reproduce it. We would be glad to do that on request.

**The Chairman:** This is not the question. What we have to face at the moment is what part of the brief we have to print as an appendix to our proceedings.

**Dr. Keys:** I understand, Mr. Chairman. We could make it available for anybody else, if you wish not to print it.

**The Chairman:** So we would print as an appendix to the proceedings this afternoon all sections of the brief up to and including Section 2.8.

**Dr. Keys:** That would be fine, Mr. Chairman.

**The Chairman:** Is that agreeable?

**Hon. Senators:** Agreed.

**The Chairman:** Dr. Keys, would you like to make some kind of opening statement before we reach the question period?

**Dr. Keys:** Perhaps I could take just a few minutes, Mr. Chairman.

Honourable senators, as the chairman has pointed out, the brief is extensive, and I suppose this is in the nature of responding to the questionnaire as we saw it. I do not want to take up your time in trying to lead you through it. I am sure you have had a look at it and will have some questions. There are, however, a few things that I thought it might be worth while highlighting. The first is some of the organizational changes that have taken place since the last brief. About the time that we submitted our last brief the first thing that happened was that astronomy was transferred from Energy, Mines and Resources to the National Research Council. Shortly thereafter the Department of the Environment was formed, and one major part of the department went to the Department of the Environment, namely the water sector. This resulted in some reshuffling and reorganization within the department, giving rise to a different program activity structure, which we have presented to you in the brief, and which I will just refer to as the mineral and energy resources program and the earth science program, the third one being the administrative program.

The second point I should like to highlight is one which senators are very familiar with, namely the action that has taken place external to this country in the intervening period. The particular one I refer to is the action taken by the OPEC countries, and the effect that has had on Canada's outlook for resources in the future. I am sure you will want to explore this later on.

The response of the department has been many faceted. I guess you may wonder to what extent, and perhaps we will talk about that. Certainly in the policy sense Mr. Gillespie and his predecessor have been active. In the R&D sense, which is perhaps something we would want to look at, we have established within the department an Office of Energy R&D, and have accepted the responsibility for each year preparing, on behalf of the departments of the federal government, a summary, analysis and assessment, if you wish, of the energy R&D programs carried out by the federal government. That is now in a compiled form, which I would like to talk about perhaps some time later.

We also have an Office of Energy Conservation in the department, whose main function, of course, is not to look at supply but to look at the demand and try to reduce the demand.

Next I should like to mention something which I am sure has been mentioned before, but it won't hurt to mention it again, namely, Canada is a large country which comprises approximately 3.8 million square miles; it has upwards of



20 million people, so there is a lot of land and very few people. Part of the mandate of the Department of Energy, Mines and Resources is to attempt to describe that land so that we will be able to use it and manage it better in the future.

I think that these days the question that is foremost in the minds of most of us who are involved in science and technology in the country, and one which has received a lot of attention, is technology transfer. In our brief we have tried to highlight a few examples of how the department attempts to do its technology transfer. There are two main areas, although I would not want to exclude the other ones. The high technology area, as I would call it, because it is in the forefront, is the Canada Centre for Remote Sensing, which employs, of course, American-borne satellites, and we obtain information ourselves from that. The second one is the work that we do on behalf of the mining and metallurgy in Canada. I think I should highlight to you the extent of industrial participation because of the interest in the department and the number of resources that are applied to industry as opposed to in-house. Figures that were included in the brief included those that relate to scientific activities. In addition to that, we also have other activities that we, if you want, contract from industry. The net result of this is that the department and the S & T sector itself puts out somewhere in the neighbourhood of \$18 million per year to industry. You might want to question us a bit more about that.

**The Chairman:** Is this the total, including everything that you give to industry?

**Dr. Keys:** To industry, to help us perform our R&D tasks. It does not include the purchase of pencils, paper and things of that nature.

**The Chairman:** This is only for R&D?

**Dr. Keys:** In support of R&D. I want to introduce that, if I may, because of the new thrusts of the government to try to increase the scope of the make-or-buy policy. I would like the senators and yourself to be aware of the extent to which we are already committed to industry.

**The Chairman:** I think this might shorten the discussion later on. What is the total budget of your department for R&D?

**Dr. Keys:** It is approximately \$97 million for all scientific activities. For R&D it is about \$42 million. I could give you the exact figure, if you wish.

**The Chairman:** We have had great difficulty in getting a single set of figures.

**Dr. Keys:** I can appreciate your problem, because we have the same difficulty. Perhaps that is one of the things that we might want to talk about later on, namely the question of how we can do better in terms of getting commonality among these figures.

The annual budget for the S & T sector, including the Office of Energy Conservation and the Office of Energy R&D is \$97,956,000 for 1976-77, exclusive of the moneys that we earned through the sales of some maps and things of this nature, which amount to about \$2.8 million.

I did want to say a word about, I suppose, the nurturing, as I might call it, of science. I am not going to talk about more money for science but the nurturing of science. I

think the issue that most of us see there is not perhaps one quite so much of funds as it is of continuity and the way in which the funds are applied. I guess a scientist is no different from any other person who is attempting to do a job. He would like to think that his job is appreciated, that what he is doing is important to the country, and he would like to be able to finish it. Sometimes, because of priorities and the need to solve immediate problems, people are shifted, and it is one of the things that I would like to see us try to avoid.

I would also like to see us try to avoid the reduction of large amounts of money at any one time. I think the large infusion of dollars in the R&D field without the capability to follow through is a waste of money. I think that large reductions can lead to, perhaps not irretrievable, but certainly losses that can be very severe in the future. I am pleading for some evenness in the way in which we do our funding.

I should like to emphasize that I believe that if the government and representatives of the people wish to get good science advice, they should ask good scientists. I think there are ways in which we can find out who our good scientists are. Every scientist may not speak with the same voice, which may not be surprising, because different people interpret different things in different ways, but we should ask the best and I believe the political process to be quite adequate and up to the choice and decision-taking.

The final point I would like to touch on briefly is that in my opinion the problems facing this country are severe. There are financial problems; there are people problems; and, of course, the fact that we live in a world in which other people have interests and self-interests, which make it difficult. In the realm of science and technology I think the way out of this is to look for new structures between government and industry. Many people feel that the time has passed when we can say "them and us". In my limited knowledge, this is true in industry as well as government. I would not want to say that necessarily the Pan Arctic model is the ultimate, but the fact that the government is willing to enter, in one area, into agreement with the private sector leads me to believe and to be hopeful that we may be able to arrive at some arrangements in the not too distant future whereby we can have the same kinds of arrangements to focus on R&D arrangements within the country.

I will stop there, with your permission, Mr. Chairman, and answer any questions with respect to the brief we have submitted.

**The Chairman:** Thank you very much, Dr. Keys. Senator Bell?

**Senator Bell:** Thank you, Mr. Chairman. I would like to deal off with a complaint arising with respect to page 16 of the brief. It was really the bilingualism which I found so difficult in this brief. The further I read, the worse it became, I am afraid. Here is an example:

The Inter Agency Committee on Remote Sensing (IACRS) is chaired by EMR and includes, at ADM level, the Federal agencies, DOE, IAND, AGR, EMR, DND, MOT—

It goes on and on. To us laymen—

**Senator Godfrey:** That is not bilingualism; that is jargon.

**The Chairman:** Do you call this French?

**Senator Bell:** No, it is bilingualism, neither French nor English. But after I got used to this I really did find it very interesting.

**Dr. Keys:** Thank you very much, senator. I think I can appreciate the problem you have, because I have the same problem myself. I think all of us do, because of this terminology and the acronyms which arise. I know that people who are expert and deal with these particular things every day forget that there is an audience.

**Senator Bell:** That is true; you might have difficulty with TSP, TBS, LBs and this sort of thing, also.

**Senator Yuzyk:** Even with ADM.

**Dr. Keys:** You would probably get the wrong interpretation, as well as everything else.

**Senator Godfrey:** I came across the same type of thing and I had to go back and find out what these strange creatures were.

**Senator Bell:** It is a communications block.

**Dr. Keys:** I recognize the problem and we will take note and the next time around do better.

**Senator Bell:** Thank you. My second question may seem impertinent, but it is not meant to be. I wondered, because EMR is so closely tied up with things financial and everything has an economic twist to it, is it any help to you that Mr. Shoyama is now in Finance?

**Dr. Keys:** Well, senator, I am not sure as an S and T man that I am in the best position to answer that, but that would be dodging the issue, I suppose. I would think that the experience that Mr. Shoyama had with the Department of Energy, Mines and Resources would be most helpful to him in his post at the Department of Finance. The relationship between our department and the Department of Finance, as you pointed out, is very close because of the policy implications in both the mineral and energy area, particularly the mineral area where, of course, the question of this export, and so on, of minerals and how it impinges upon the economic policy of Canada is very great. All I can tell you, as I am sure you have heard from everyone else, is that the liaison between departments is very good.

**Senator Bell:** I would like to start off by asking you what you think is the main problem as to research and development within your organization, and what you are doing about it.

**Dr. Keys:** If I used the word "stagnation", I wonder whether it would be a good description of what I feel to be our problem and perhaps that of other people also. It is stagnation, not from the point of view of the interest and willingness of people to do the work, but the fact that the problems are just so great that it is nearly impossible to make a dent in them. The question that I referred to earlier on about the resources and so on, what are we going to do about the energy resources, is our problem in our department and in the S and T sector. The problem there is to get the best possible advice to our minister and, through him, to the government as to the resources we have available.

Secondly, we have to somehow instil in the country as a whole the conservation ethic. There is no question about this. That, again, is our responsibility, as I think we all know. The ability, or lack of ability to turn public mores, if you wish, from a direction which has been on the upswing

of consuming for many years to one of level-off, and perhaps decrease to some extent, with a concomitant decrease in the standard of living, is a very difficult one. Those are areas which I think are crucial to our department and to the country. That is why I think that our department has a key role to play, which is difficult.

I probably should highlight some of the concerns relating to the basic gathering of data about our country. One is, of course, the fact I mentioned earlier, that it is a large country. We do not have very many people. I do not know whether a comparison would be of any interest to you, but if one looks at the geological survey in the United Kingdom, one finds that there are as many geologists there as there are in both the provincial and federal governments in Canada, and you can see the difference in size between the two problems. However, beyond that is the question of, having got the information, how is it to be managed? One thinks of the information not just as residing in an archival sense, but it must be continually updated and validated. New technologies come along which make the old information, perhaps, not as good as the new information and the whole question of the management and dissemination of the information that we collect on Canada is a major problem that we are going to face in this country.

Does that give you a flavour of the problems that I see?

**Senator Bell:** Yes. It would be difficult to pick out because, as you say, there is such a broad spectrum. It is your responsibility, and we ask, what are you doing about it? We have all these pages that show what you are doing about it, but I think we would find it interesting if you could pick out one aspect that you can see the beginning of and if it is a long-range plan, the end or goal in sight. Can this be achieved as you see it now, or will urgencies keep pushing it off its track? If you think of the long-range efforts as your main problem and urgencies keep cropping up, is that a way by which you could tell us what your main problem is?

**Dr. Keys:** Well, I could highlight that. I will try again: In data management the acquisition and management of those data, there are many customers for the department's collection of data on Canada's land. They want it in different forms, at different times and to a different level of detail. We can collect it gradually, over a period of time, but once it is collected, how do we get it into a form in which people can use it? We have over the last few years in the geological survey, for instance, continually allocated more and more resources to the management of those data so that when we want data to endeavour to evaluate what resources of oil and gas, for instance, we have, we can get them out. They are collected in the field, recorded in notebooks, put into data banks, put into maps, but someone has to analyze them, which is a major problem which will get worse, not better.

As to the question of the actual field operations, in terms of actually collecting the data, although I am not sure that that was the thrust of your question, many years ago it was identified within the Department of Energy, Mines and Resources that it was time to find out what we could about the tar sands. There have been other pressures in the meantime, such as the question of a pipeline, or more than one pipeline coming from the Arctic, the question of whether or not we know enough about the geology and the land mass in order to make sensible decisions about the directions and the effects that that will have on the environment. There is a need, as we have seen from Mr. Gillespie's recent strategy for energy that has been published, to



look very carefully and try to assess what we can do in terms of the frontier resources. There are also the energy resources which must be looked at and will be coming on board, I am sure, from offshore Labrador. Therefore, we feel we must have a sustained effort in this country to make sure that when we come to develop those resources, that the population generally, and particularly those taking decisions about the future of the country, know as much about what is happening as do the people exploiting these resources, who may not necessarily be Canadians.

**Senator Bell:** So that the sounder the data base, the better the decision?

**Mr. Keys:** The sounder and the better managed the data base, the better the decision. I look upon a data base as I do a bank. A data bank has to be managed. You put information in and you take information out, and you get statements from time to time as to what the data bank contains. A record has to be kept of the ingoing and outgoing information, and someone has to validate that record, which is not a small job.

I do not think that the particular problem I highlighted is unique to our department. The uniqueness in terms of our department, if that is the word to use, is the fact that we have such a large land mass with very few people on which to call.

**The Chairman:** You say you conduct surveys and accumulate data banks on land uses in Canada. We were told yesterday by officials of the Department of Agriculture that they, too, conduct surveys. I am sure the two departments have different interests.

**Dr. Keys:** Absolutely.

**The Chairman:** To what extent do the two departments work together on these land use surveys?

**Dr. Keys:** The one very close link we have, Mr. Chairman, is through the Canada Centre for Remote Sensing, which, essentially, looks at Canada's surface land mass. We can, through expert examination of the photographs, say something about crop yields, the state of forests in the country, the water surface in the country, and so forth. All of these things, of course, are of interest to the renewable resource people.

The question I think you are aiming towards is how do we marry the agricultural data, the water quality data, if you wish, the forestry data, the land data, wildlife data, and so forth. Having spent some time in the information field myself, that is a question I am interested in.

What the Department of Energy, Mines and Resources has set out to do, having the geology, essentially, the subsurface, although some of the surface information is present, too, is to set up a central group which attempts to pull together the data collected by the various elements within the Department of Energy, Mines and Resources—and this is done in cooperation with the provincial agencies which collect data as well—with a view to eventually—and this, again, is perhaps a pious hope—being able to answer questions about a given area of land, both in terms of its extent and depth, and so forth. Given that data base, it is hoped we will be able to answer those questions—"we" being the Public Service.

**Senator Bell:** When your predecessor appeared before this committee in 1968, he seemed to make an almost desperate plea to have flexibility in staff and not be too

tied up with the Public Service concept of staffing. He wanted sufficient flexibility so that if he saw a great brain walking around loose, he could snatch that brain and put it to work, notwithstanding that there was no work in that particular field at that time. Has there been any improvement in that regard since then?

**Dr. Keys:** If I saw a good man walking around on the street, Madam Senator, I do not think I would have too much trouble getting him on board. I am not sure what my predecessor was referring to specifically. I would refer to it as part of the problem that we face in this country—and it is not unique to us—as to how many of these good people can the government bring on board. Quite clearly, everyone cannot work for the government. To the extent that we are allowed in terms of the controls and the desire of the government not to increase the Public Service unduly, a research scientist can be hired fairly quickly. The same may not be true in respect of some support staff.

**Senator Bell:** You are not suffering as much from the freeze, I gather, as are some other departments?

**Dr. Keys:** I think we are all suffering from the freeze, Madam Senator. I do not see any point in my highlighting it. It has been highlighted before. It has been well documented in the press. We are suffering under the freeze, as is everyone else.

**Senator Bell:** You are working on a way to cope with it?

**Dr. Keys:** We are trying to cope with it. We have coped with it. In our office of Energy R&D, we have had secondments of people who have come to us from other departments. Other departments have been willing to let people go. We would do likewise, if such expertise were required for a national emergency.

**Senator Bell:** So there is a bit of flexibility?

**Dr. Keys:** Yes, it is give and take.

**The Chairman:** I think what Senator Bell is referring to is a statement by your predecessor to the effect that it was more difficult to move one public servant from one department to another than to move that public servant from a federal department to a U.N. posting.

**Dr. Keys:** I realize there is a mobility problem, Mr. Chairman, within the government. It is not so much a problem of bureaucracy, if you wish; rather, it is more a question of an individual working in one area wanting to complete a project. Therefore, as long as that individual feels productive and wanted, and is rewarded in a way in which he feels is appropriate, which generally does not involve money, then he or she is prepared to remain with that project.

There is no person in our department of whom I am aware who has refused to take a secondment to another department for the duration of a problem or issue that has to be settled, and our department has certainly benefited from the cooperation of our sister departments and agencies in this regard.

**Senator Bell:** Dr. Keys, I think you put it very succinctly in your opening remarks when you said that in probably 25 or 30 years we will need a completely new outlook, a new technology to cope with things, and so forth.

We are going to have social and economic disruptions on a vast scale. Even after reading your brief, I am not fully

reassured that we are going to be able to cope with this mentally, or that we realize the extent and the vastness of these disruptions. Is that a responsibility of yours, or is that more a political responsibility?

**Dr. Keys:** I think the political area is the one that will act, but I think it will have to act on advice it gets from people such as my colleagues in the department. I emphasize the word "advice" as opposed to "opinion." It has to be advice based on a rationale rather than simply what someone thinks. That is going to be the difficult issue in terms of the change in life-styles, as I am sure you are aware.

**Senator Bell:** Perhaps to illustrate my point, I could read from page 32 of the brief, as follows:

Future plans concerning energy supply will probably be more dependent upon the discovery of oil or gas on the Offshore or in the Arctic than on new scientific developments.

Yet, if we take the point of view that the proven reserves, including the tar sands, and so forth, that are strip-minable—that is the only known technique right now—the North American life consumption at that point, the reserve life, would be four years. Then there is another assumption, if you like, that the total natural gas reserves, including the Arctic, which we may never have available, are 30 months at current North American consumption.

Those are two aspects of it. I am wondering if there is a contradiction in terms with respect to what is set out on page 32 of the brief, that Arctic and offshore discoveries are going to be more important than scientific developments. That is a fairly short lifespan in respect of those fuels.

**Dr. Keys:** I do not know whether I am going to answer the question exactly, Senator Bell, but in terms of the tar sands, the tar sands are not really expected to come into production for another 15 or 20 years to any significant extent.

Dealing with the question of what are called the frontier resources, I do not think I can give you an answer, nor do I think anyone else can at this stage. The estimation of the resources we have in the North will be changing, and perhaps we will want to talk about this at a later stage in the discussion. I am sure they will change over a period of time. Under almost any circumstances, it is debatable at this time whether or not those resources will be economic. However, I do think that there is a role to be played by science and technology in the development of those resources. If one looks at the cost of oil and gas at the wellhead in the Arctic, wherever it may be—and there have been many guesses on this—it seems that the one way to reduce that cost is to increase the length of the drilling season. We have a federal government oceans policy which stipulates, among other things, that we should strive to operate efficiently in and over ice-covered waters. It seems to me that to accomplish this we must extend the drilling season in the northern regions. There may be other ways of reducing costs, but extending the drilling period from a few months to many months could be a significant factor in reducing by a quarter to a third the cost of oil and gas at the wellhead.

**Senator Bell:** But if it is only going to last us, say, for four years, is it worth all this effort and expense?

**Dr. Keys:** Yes. It may be a crucial four years. I would not like to try to validate or debate the four-year philosophy,

but I think there is a philosophy that one has to bear in mind. It is that every age has a responsibility towards the following age, a responsibility to ensure the survival of necessary resources. I am not talking about dollars but about all human resources, and a four-year crucial period could be enough to move us over the hump. So, I would not want to discount those four years, which could be crucial. I am sure that you have looked at this problem much more closely than I have, but the frightening aspect of what we are faced with in the energy field is twofold. First, the dollars that are required. Whatever you do, whatever option you choose, you are talking about a billion dollars, plus or minus a few hundred million, to get something going. Then there is the time element. Any decision taken today will not be felt for seven to ten years. That involves a serious policy implication, and no matter how good we are at our technology and science we cannot bridge that gap.

**Senator Bell:** On page 31 of the brief it says that all coal gasification is developed abroad. I am wondering why the Alberta effort is not being considered in this.

**Dr. Keys:** I think what is being referred to here is the proven technology, the one technology that has been proven to exist. It is called the Lurgi technology, and it is the only one that has been shown to work up until now. Certain efforts are being made in Canada but they are being dwarfed by the efforts being made by our neighbours to the south.

**Senator Bell:** Well, in a way they have different problems than we have, do they not?

**Dr. Keys:** In coal gasification, do you mean, because of the difference in the quality of the coal?

**Senator Bell:** Yes.

**Dr. Keys:** That is part of it. We have a range of coal too, and for lignite we would probably look to the Saskatchewan fields first. Lignite seems to be the type of coal—although not being a coal expert I would not want to get into details—that one would look to first for gasification.

**Senator Bell:** All right, let us take Saskatchewan. I am not a coal expert either but with the Lurgi effort, I cannot understand why have not a little piece of the action in say, Westfield, the British Gas Corporation in Fife. As far as I know, Trans Canada Pipelines has the only Canadian money in there. The amount is very small and there is some doubt that it will be continued. It seems to me that some Canadian public funds should be made available here.

**Dr. Keys:** I am interested in your philosophy, and perhaps this should be done by way of federal activity, by way of public funds rather than private sector funds.

**Senator Bell:** I am rather pleased that Trans Canada is doing this, but I think we ought to have something to say about this as a national policy.

**Dr. Keys:** It raises in my mind the question of the extent to which public funds must intervene in the private sector in order to do things that are necessary for this country. I guess our government feels that this is an essential element, because we do have PanArctic and Petro Canada, and I suppose there are possibilities that in the future the federal government could engage with the private sector in research and development in other activities such as this.



In fact, I probably mentioned that as something which might arise. I would not discount, either, the involvement of the provincial governments, who, of course, own the resources in the ground. I could conceive in the case of coal, for instance, that perhaps a tripartite arrangement could be made between industry, federal government and provincial government and that might be the way to tackle it. But, even that has its hazards one of which is that once we involve one industry what do you do about all the others. I am sure you have all read the article recently in the *Globe and Mail* which was not very complimentary perhaps to somebody's perception of what it was we were failing to do in one element of my department, and that is really a reflection of what happens when you have had a chosen instrument and cannot afford more than one. Somebody wins and somebody loses; if you win you are smiling and if you lose you are very unhappy. We would all feel the same way. But that in a sense is a bit of a policy issue as far as the government is concerned too. Are we prepared to take that step in some cases? I would suggest that if we went into coal gas location—and the scale again is expensive—we would be faced with a choice and essentially, I think, it falls on the politicians to defend it.

**Senator Bell:** They should give leadership then with the advice.

**Dr. Keys:** I would expect they would.

**Senator Godfrey:** Getting back to this input of data from the department, I am curious as to the process by which Senator Greene when he was minister predicted that we had something like 900 years of oil and 450 years of gas.

**The Chairman:** Let us put the correct figures on the record. He said that there was 923 years' supply of oil and 392 years' supply of gas. That was at the 1970 rates of production.

**Senator Godfrey:** I asked some industry leaders this, and all they could say was that they were very embarrassed.

**Dr. Keys:** I am not embarrassed at all. The issue that arises there is two-fold, I think, and one of them is the question of the difference between reserves and resources. You can be very optimistic and say that because we have certain types of geological structures that have produced oil and gas in the past we infer that they are there when similar structures are found through our methods of remote sensing seismic and other means. Since a particular structure in one location has given us oil and gas in the past at such and such a production rate and we have a seismic record elsewhere which indicates a large body of the same kind of formation therefore it is going to give us the same and we are going to assume that that is full of oil and gas. The trouble is that when you drill it you find that there is nothing there. It is gone, and there are a number of reasons why it could be gone if it ever was there. I think that is one of the issues that arose at the time that Senator Greene made that statement.

The second one, and this is simply the name of the game, is that our methodology in focusing more sharply on what we have and what we do not have has increased tremendously and I, like some of my colleagues, and I am sure my minister and other members of the government, live with some concern that the predictions that are being made now and that were published five or six months ago will not in fact stand up very long and I would suggest without prejudice that perhaps there will be alterations and I think

there should be. I hope that the alterations will not be as significant as the ones that have taken place since those that Senator Lamontagne referred to were projected into the public domain.

**The Chairman:** Harrison Brown, in his book in 1954, and King Hubbard in the United States have been fairly successful in forecasting the oil shortage in the United States over a long period of time, and in the last four or five years we have had to change our estimates so dramatically.

**Dr. Keys:** Well, I think, as I tried to explain and I am not sure that I can totally put it in that context, but it is a difference between an optimistic statement as opposed to a more realistic one that I think we should use now. It is possible that in making that estimate Mr. Greene was in fact talking about the ultimate.

**Senator Godfrey:** Were you relying on the oil industry's own estimates at that time?

**Dr. Keys:** Senator, we have always—or at least for several years past—had records of the wells that the oil industry has sunk, and I would invite you, any of you, to come to Calgary some time—and please take me up on this—and go to the Institute of Sedimentary and Petroleum Geology and ask to see one of the records. Just ask, and they will show you, and you can choose which one you want to see if you know which one you want to see if you know which one it is. These records, of course, are not available to the general public, but they are available to people who have a need to know. They are there, and I have seen them and I have verified them for myself. I have seen an oil well in the Arctic and I have come back to the institute and I have said, "Please show me the log records," and they have shown them to me. So we have had those in the government and we have had them for years. The National Energy Board up until six years ago, until we had an energy sector within the department, were the ones who were keeping track, if you wish, of the situation in respect to oil and gas.

**Senator Godfrey:** So what I get from that is that you got the actual records from the industry so that you could make your own judgment.

**Dr. Keys:** The judgments were made by the National Energy Board. The records were available.

**Senator Godfrey:** So that they cannot say that the industry misled us so that they could increase their exports to the United States.

**Dr. Keys:** Well, it is a statement that has been made quite often but there is also a judgment factor. If you and I, Senator, were to look at those records, having the same degree of background in geology, we might arrive at very different conclusions. My colleagues in Geological Survey would arrive at a different conclusion in respect of resources than would Mr. Heatherington. That is not to say that one is right or wrong; it is a question of difference in interpreting something that you cannot measure with the five senses that you have. You have to use some remote sensing. So there will always be differences in estimates in my judgment between what petroleum companies estimate and what other people estimate. In terms of our own estimates, I am not talking about the department as opposed to the National Energy Board. There would be small differences because they are different people with different backgrounds but I would hope that those differences would be marginal rather than gross.



**Senator Yuzyk:** Well, have some of these oil companies been fooling themselves in regard to these estimates? I can imagine that you could have certain estimates for the public which would be good for bringing in shares, and then have other internal estimates which would be a little closer to reality.

**Dr. Keys:** Well, senator, I am sorry but I have not worked for oil companies and I cannot comment on that, and I am not sure that I should be a public servant. I am not sure how they do their estimating.

**Senator Yuzyk:** Is there such a system in the oil companies in general?

**Dr. Keys:** I am sorry, senator, I don't know.

**Senator Godfrey:** I think the implication in the press was that in order to get export permits they were inclined to overestimate the reserves. I think that is the accusation being made so far as I can gather. But I also gather from what you said that the National Energy Board and the department did not rely upon the oil companies' own estimates because they had the factual data on which to make up their own minds. So those accusations in the press were not correct, that you relied on the judgment and opinions of the oil companies who wanted to export more oil and gas.

**Dr. Keys:** That would not be my interpretation of the way in which the department has done its business.

**Senator Godfrey:** In fairness to the oil companies I think we should make that clear. It is the first time I have heard that statement.

**The Chairman:** I think this is the first time I have heard it too.

**Senator Lapointe:** You say that continuity is very important. Who decides about stopping a researcher, for example, from going on with his work? Does his boss decide that he should stop going on? Is it lack of funds or lack of judgment? Is the quality of his work or the necessity of his work?

**Dr. Keys:** I think the last four we can say "no" to. It is none of those. It tends to be a situation, that has arisen in the past, where resources have been limited in geological surveys, for instance, and a decision had to be taken to shift people's activities from one part of Canada to another. It was clear some years ago that the Arctic pipe line was going to be at least a possibility. The question arises: What are the geological implications? What are the formations in the Arctic that need to be looked at if we are going to put a pipe line through? We should know something about the geology. A decision, a conscious decision, and a right decision in my judgment, was taken to re-allocate, if you wish, resources from bedrock geology in some parts of Canada to the Arctic, and that was done. The result is that there are some parts of this country in which at the present time we do not have a bedrock geologist for a geological survey. You may think that is strange. But let me go back to the size of the country, the urgency of the problems, and to some extent the fact that these problems are upon us, they are here.

**Senator Yuzyk:** You do alert the universities in this instance about the lack of geologists in particular?

**Dr. Keys:** I would be delighted to except that I cannot offer them a job. I simply cannot. We can use them in the

summertime to help us, but I guess the main task of a university professor is to be with his students and advance knowledge from that point of view, so you cannot make full-time use of university staff.

**The Chairman:** I believe that this morning I interrupted Senator Buckwold, who was interested in hearing some new estimates about our resources, more particularly uranium.

**Senator Buckwold:** We had Atomic Energy of Canada here this morning and, quite rightly, the Chairman cut me off in asking them about the potential uranium deposits and supply for the future. We were having quite an in-depth discussion about the future of nuclear power in the country, and I presume the uranium supply becomes important. I was asked to hold the question over until this afternoon so that perhaps you could give us some information.

**Senator Godfrey:** Let us see if you can do better with uranium than with oil and gas.

**Dr. Keys:** I just happen to have with me a document, which I should be pleased to distribute. It has been put out by the department, and shows the 1975 assessment of Canada's uranium supply and demand. I do not know whether you would like to have this tabled, or just have it circulated.

**Senator Buckwold:** Perhaps it could be tabled, and maybe you could now verbally summarize some of its highlights.

**The Chairman:** Senator Buckwold only wants to have a figure.

**Dr. Keys:** On page 4, Table 2 is entitled "1975 Estimates of Canada's Prognosticated Uranium Resources." This is in terms of mineability. It is also given in terms of dollars per pound of uranium oxide. Up to \$20 a pound the mineability figure is 160,000 short tons.

**The Chairman:** What is the current price?

**Dr. Keys:** I do not know exactly what the current price is. My colleague, Dr. Niblett, indicates that it is about \$40.

**Dr. Ron Niblett, Division of Geomagnetism, Earth Physics Branch, Department of Energy, Mines and Resources:** I think so.

**Dr. Keys:** Maybe I can get a note on that from one of my colleagues and we could look at it in a moment. At \$20 to \$40 per pound it is 282,000 short tons. That gives a total of 450,000 short tons of uranium oxide.

**The Chairman:** Which would mean at an exponential rate we would have supplies for how many years?

**Dr. Keys:** May I turn that around a little bit and say that if we go at the current projected rate of increase, given that the current usage is 700 tons per year, at a 7 per cent increase by the year 2000 we will require 130,000 tons.

**Senator Buckwold:** A year?

**Dr. Keys:** By the year 2000 we will have consumed or have required—in other words, put into use—130,000 tons.

**Senator Buckwold:** Did you work out at what point we would find ourselves without an adequate supply, keeping in mind your 7 per cent growth factor?

**Dr. Keys:** You won't like my answer, senator, but I must try to be truthful.

**The Chairman:** It is a guessing game.

**Dr. Keys:** Yes it is. I would like to refer, if I may, to a statement made by Dr. Ben Lewis, Director of Research at Chalk River, some years ago, in which he said publicly that there was an essentially infinite supply of uranium if you were prepared to take it out of the water in the ocean. What that does is put the economic aspect of it into play. I cannot speak for my colleagues who are not here, but I would be surprised if they would want to answer that question directly.

**Senator Buckwold:** There are statements being made now, reported in the press, that in a relatively short time, looking into the future, we would not have in Canada adequate uranium reserves to take care of our needs. I gather from you that, from your point of view at least, this probably is not realistic, that we would have?

**Dr. Keys:** In my judgment, based on the information I have, we will be in no trouble up to the year 2000.

**Senator Buckwold:** The year 2000 is only 24 years away.

**Dr. Keys:** That is right.

**The Chairman:** What about thorium, which could be a replacement by that time?

**Dr. Keys:** It certainly could. The question of burning thorium in addition to uranium arises. I do not have estimates of the thorium reserves, but they are large.

**Senator Buckwold:** If you use plutonium, would that significantly conserve the use of the uranium?

**Dr. Keys:** You are now taking me into an area that probably should be answered by representatives from AECL, because it requires a different type of, if you want, reactor to use the plutonium.

**Senator Buckwold:** You prefer not to answer that?

**Dr. Keys:** I prefer not to because I think that would be outside my competence.

**Senator Buckwold:** I am glad to get that straight, because we are putting a lot of money into nuclear power research and development, with the likelihood, in the eyes of some, of not having the reserves. I am relieved to know they are available.

**Senator Godfrey:** I am not relieved. Twenty-five years is not very long.

**Senator Buckwold:** Twenty-five years is certainly no problem, but we are looking at 100 years ahead, I am sure. That is what you are talking about.

**Dr. Keys:** A hundred years ahead I am certainly not prepared to say, and I doubt if any of my colleagues would be prepared to say either. As time goes on we will do our best to try to update this. That is all I can promise. One manifestation is this annual report that is being put out, which will give our current estimates. I would be surprised if you actually saw a tremendous change in these figures. I think it will be gradual over the years as our exploration goes ahead and as we develop some more. It is not quite like oil. You find uranium; it is there. It is not like finding a structure for oil and gas which may or may not contain oil and gas.

**Senator Bell:** I should like to ask a supplementary to Senator Buckwold's question. Of the uranium that we have in production now, 85 per cent is committed for export I believe.

**Dr. Keys:** I am sorry, I would have to pass on that. It is outside the particular area in which I would be competent to answer.

**Senator Bell:** I was just wondering if that would enter into the total. The Americans do not get any from us; they are about run out and where they are going to fill the gap I do not know, because we will not have it for them. Without making any promise, I suspect that my minister will be looking very carefully at this over the next short period of time and perhaps there will be some position announced by the government with respect to this. Of course, however, this goes away from the arena which is S and T.

**The Chairman:** But is not a condition at the moment that we must be assured of a supply for at least 30 years, or something of that nature, before we increase our exports?

**Dr. Keys:** I believe there is a restriction of that nature on it, yes.

**Senator Yuzyk:** Now that we are discussing estimates and we do not hear so much about the estimates regarding minerals being questioned, they also being non-renewable resources, do you have projects into the future, that is estimates of your supplies and potential supplies, for instance of iron, copper and nickel, all of those that are also necessary for the functioning of energy-consuming factories or any other installations in Canada?

**Dr. Keys:** My colleague, Mr. J. P. Drolet, ADM in charge of mineral development, has that whole area under his particular concern and purview. The policies that Canada should have with respect to these resources are within his work and within his responsibility. As you know, he has put out in the past, a year ago I believe or perhaps a little longer, the first stages of a mineral policy. I would expect that within the not too distant future we might have a sequel to that which would raise the issues as to what faces Canada in respect of the development and use of the mineral resources, which includes, of course, the extent to which we have them and the extent to which they might go on.

**Senator Yuzyk:** Are you going to be subjected to a shock treatment of some kind also at some time regarding copper or nickel?

**Dr. Keys:** I do not think I can give you a yes or no answer, but I do not feel that there will be a shock treatment.

**Senator Yuzyk:** You are a little more optimistic there than they are with respect to oil and gas.

**Dr. Keys:** Yes; I wish to try and distinguish, if I can, the oil and gas situation again. I know it will be repetitive.

**Senator Yuzyk:** Yes, but it is related in a way.

**Dr. Keys:** Except that I tried to make the point that with oil and gas you look at a geological structure and say that probably has it drill the hole and it is dry. The same thing is not true with mineral deposits, which do not disappear. The extent to which it is there and the extent to which it is mineable is another issue.



**The Chairman:** So that your estimates of other minerals are likely to be better than those for oil and gas.

**Dr. Keys:** I think that once we can establish the data base our estimates will be better. I do not know whether I am getting outside my competence again, because I know, Senator Lamontagne, that you and your colleagues are interested in a broad range of issues which go beyond S and T. However, the question is where we get our data upon which to base our estimates, because we not have the drill holes and do not drill all the time, so there is a different procedure.

**Senator Yuzyk:** Yes, but they are prospecting all the time.

**Dr. Keys:** Yes, and that will give you some indication, but the question of prospectors' records is a vastly different matter than the question of oil companies' drill logs.

**Senator Yuzyk:** If I could nibble at Dr. Niblett a little bit: Geomagnetism just does not ring a bell, not a clear bell, for me anyway. Could you explain what this is and how it is related to EMR?

**Dr. Niblett:** Geomagnetism is one of the divisions in the Earth Physics Branch. The mandate there is to map earth's magnetic field over Canada and provide information of its time changes from magnetic observatories for studies of the variations in magnetic field, which changes with time. It is also to study the magnetization which was locked in rocks and which was put in place there at a certain time during the rock's geological history, either when it cooled from lava or during whatever process was involved in its formation. So we can use this data for information on ancient magnetic fields of the earth. From that information we can infer the relative position of continents, or the distribution of land masses at different epochs. Also, for a large land mass, such as North America or the Canadian part of it, we can begin to develop a picture of how the various provinces were developed, how they were put together; whether at one time, for instance, Grenville province of Quebec and Ontario was several thousand miles away from its neighbouring Superior province and what implications this historical information has in the formation of economic mineral deposits. There are two elements here, the understanding of present geological conditions, which is a separate subject, and also the time element factor, how these structures came to exist and how they inter-relate to each other in time and space.

**Senator Yuzyk:** Is this a more sophisticated study of rock and soil formations, or is it mainly just topography?

**Dr. Niblett:** No, it is not topography; these are only some of the concerns in the study of geomagnetism.

**Senator Yuzyk:** Can it be used to measure to some extent some of the resources that we may have underground?

**Dr. Niblett:** No, it is things such as aeromagnetic surveys, various geophysical and geological surveys, which are useful for measuring resources that exist. However, it is the geological history and the tectonic development of the land mass which is important in understanding how minerals were formed in the first place. When two continents come together or when ocean floors are over-ridden by continental material, we get all kinds of geochemical reactions. It is this type of thing which has been developed over the last ten years, and it's main concepts are largely

dependent on the subject of magnetization in rocks. That is how we got at it in the first place.

**The Chairman:** I am under the impression, although I am sure we are not on the verge of an election, that we are on the verge of some kind of revolution. Since we started our review of the field of science policy we have been told by MOSST that the make-or-buy policy is under review; we have been told by the Department of Industry, Trade and Commerce that the whole sector of grants and incentives to industry for R&D is under review; we have been told that the Department of Agriculture is now reviewing its future role. You state in your brief that the program activity structures of your two major programs, namely, the mineral and energy resources programs and your earth sciences service program, are currently in the process of development. Does that mean you are merely in the process of reclassifying your activities, programs and objectives, or that in this type of process these activities, programs and objectives are also under review and might be substantially changed at the end of that review process?

**Dr. Keys:** As far as the earth sciences program is concerned, I do not think there will be a major change in that particular area. However, in terms of the mineral and energy program, I think we are in the process of looking at what is needed for this country and what the responsibility of our ministry is in order to provide for and meet those needs.

In that context, although perhaps not in the next estimates, I would hope that a year from now we will see more of a reflection of what we think our department should do as our responsibility to meet all the needs of this country as far as the federal government is concerned in terms of energy and minerals, which is the total span of supply and demand and the question of conservation.

**The Chairman:** Would this result in a substantial change in your research activities and programs and goals as compared to the situation in 1968 when we made our first inquiry?

**Dr. Keys:** There would be a change, as there has been a change since that time, Mr. Chairman, in the way in which we look at our activities. There is, if you wish, the gradual shift from one type of activity into another focus. I am sure you have been told by many other people that it is almost impossible, if not totally impossible, to take a geologist and make him into a chemist. On the other hand, you can take a chemist working in one particular area and move him into another area which has perhaps a different type of relevance.

Uranium, as you indicated yourself, Mr. Chairman, is a very important issue in Canada, and one of the ways in which we are approaching our programs now—and I would not want to say that this is necessarily the way in which it will end—is to look at the totality of the minister's responsibility to the people of Canada, through his office, for uranium, which would involve the supply and demand, as well as such things as the extent to which we should be exploring and the degree to which we should be pushing to get those extra thousands which were referred to earlier on. There is also the question of the safety of the miners working in uranium mines. As has been stated by the media, and as I am sure we are all aware, that is a hazardous occupation. We cannot let people go on working in conditions such as that. We have to do something about it.

There is also the question of the disposal of wastes from nuclear reactors, which has been an issue in the newspapers for some time. Part of that responsibility and part of the answers to those questions lie within the competence of the Department of Energy, Mines and Resources. Through our geological surveys group and our physics group, we are the people who can advise the people responsible for deciding where to store these wastes. In other words, do we store them in salt domes, because salt has been there for a long time and, therefore, there is very little chance of there being water to leak some of the waste away, or do we go to the other extreme and store those wastes in granite? What do we do? What do we have in Canada? These are all facets of the uranium program, and I think we in Energy, Mines and Resources are looking at our response to those needs in that broad context, which may be a different approach from the one you heard in your first inquiry.

**The Chairman:** I should like to quote again what the Mining Association of Canada told us when they appeared before us at our earlier hearing. I quote from their brief, as follows:

We suggest that a gap has for too long existed between the prosecution of relatively "basic," as well as so-called "applied" research—as carried out in government agencies and often in universities—and, at the other end, technology in plant... While we would not presume herein to suggest and develop all of the reasons for the existence of this gap, we are of the opinion that a lack of sufficient common interest and effective communication between government research agencies and the industrial sector has resulted in a less than desirable efficiency in the utilization of the results of research.

I am wondering whether that gap has narrowed or widened since 1968.

**Dr. Keys:** I, too, would be interested in knowing that, Mr. Chairman. I wonder what the perception of the Mining Association would be today. Mine would be that we have closed the gap. I think we have closed it not only in my department, but in other departments, too. I think that particular reference, in terms of Energy, Mines and Resources, would have to be put in the context of the Canada Centre for Mining and Energy Technology. Certainly, my perception of the work that is going on in that centre is one that links it very closely to industry. I think from the examples we have given you in our briefs, both last time and this time, illustrate that. Pit slope mining, for example, was done in industry, which is a clear indication. We have industry people who actually come in and work in our laboratories and, in my view, that is the fundamental way in which technology is transferred. We cannot transfer technology by passing a piece of paper or by talking. It can only be achieved by people working together.

**The Chairman:** I have one final question related to this. You have as of now a National Advisory Committee on Mining, and a National Advisory Committee on Metallurgical Research. When were those two committees established and what are their roles in relation to your research operations?

**Dr. Keys:** I cannot give you the exact dates of the establishment of the committees, Mr. Chairman. They were established some time ago.

**The Chairman:** Was it pre-1968 or post-1968?

**Dr. Keys:** I will have to take that question as notice and provide you with that information. I shall also have to provide you with a list of the membership of those committees. Both committees operate through subcommittees that look at various facets of the operation. By and large, although neither committee, nor their subcommittees, have not met in the last year—and I will explain the reason for that in a few moments—they are there to advise the minister on the actions and activities of his work in respect of mining and metallurgy.

The committees have not met in the past year because of a reorganization that has taken place within the Canada Centre for Mining, Energy and Technology, of which Dr. Coates is the present Director General. He moved into that position rather recently and instituted a matrix style of operation, which is aimed at outputs in terms of energy and minerals. He would like, perhaps not surprisingly, to have his operation at least shaken down and producing before the committees advise him on what he should be doing. He assures me that he will be calling a meeting of these committees to look at his operation during the next year.

**The Chairman:** Surely, if those two committees work effectively, they should help in closing the gap between industry and your research operations.

**Dr. Keys:** Having had a bit to do in my lifetime with advisory committees, Mr. Chairman, I think they are extraordinarily useful and can give good, broad advice in terms of keeping one from going in the wrong direction. However, in terms of specifics of linking the work in a laboratory to the work of another laboratory, they are not as effective. It does happen. I have seen it happen where some member of an advisory committee has been a director of research and has seen something of interest to him in one laboratory and decides to send someone to that lab. I would not put a great deal of hope in advisory committees as an agency for technology transfer, if that is what you had in mind.

**The Chairman:** Not necessarily as an agency for the transfer of technology, but rather as an agency that could advise you on the kind of research you should be carrying out on their behalf.

**Dr. Keys:** Yes, they could give advice on the directions which research should take, and that advice, to my knowledge, be it to Energy, Mines and Resources, or to other departments, is generally well received and adhered to.

**The Chairman:** Senator Stanbury.

**Senator Stanbury:** Dr. Keys, I am wondering whether your organization does any research or has any input into the decision-making process as to the export of minerals and other forms of energy? Are you consulted by the energy policy sector and the mineral development sector in this regard?

**Dr. Keys:** Yes. If I can illustrate what happens: when there is a policy issue or a decision that my colleagues wish to recommend to the minister that he should take in respect of either of those two, the Science and Technology Centre is consulted to see whether or not there are any technological implications to that decision. For instance, you used the word copper. Are we running out of copper? To what extent does science and technology determine what we do in copper? Well, if there were a new process that would make it cheaper to develop the copper products



rather than just ship the ore to Japan, and if that were being done or was on the horizon in Canada, we would want to know it before we took a decision, as a government, as to what we should do in respect of the export of copper concentrates.

If there were something like that, I would expect that the science and technology sector of our department would be aware of it, would highlight it and would give us some indication of the probability of success of this new process, and the timing at which it would come on. That would be fitted into the policy decision to decide whether or not something should happen in respect to that export.

Does that give you a flavour?

**Senator Stanbury:** Yes, it does to a certain extent. What I am driving at is the concern all of us have that our need to keep up our balance of payments is now driving us toward exporting more of our exports than we should—because our manufacturing area is not developing its exports very well—simply to earn money. Not that to earn money is a bad thing, but I am just wondering to what extent we are selling our birthright for the benefit of the present generation, and whether your organization has an input into those decisions. For instance, I happen to know from personal experience in the last month or two that Spain has a large contract to import uranium from Canada. It was bought at a rather cheap price with a commitment made some time ago. It was renegotiated, and now they are going to be paying a higher price. At the same time, there is the expression in some places that we are going to be running out of uranium ourselves.

I appreciate you have given us some figures which seem to combat that, but I am wondering to what extent your department is consulted before export permits are given to allow the export of certain resources which may cause us a problem in the long run.

**Dr. Keys:** Well, the particular mineral that you referred to, uranium, is special because it is prescribed under the act of the Atomic Energy Control Board, and in that particular case we have an agency, which is one of the agencies of my minister, to look after that type of thing, and I can assure you that the input from my department, and particularly from the energy policy sector where this document originated, is well and truly made to the decision. Our people are working and producing documents such as this, so that information can be well meshed, if you wish, with the decision process of the Atomic Energy Control Board.

In the case of the broader issue of other minerals, I can only say at this stage in the game that the question of a mineral policy for Canada is one that is being generated by my colleagues in the department, and I would expect and hope that in coming forward with a policy for Canada that the implications of science and technology, in its broadest sense, will not be overlooked in the development of that policy. The example that I gave was one potential way in which science and technology could influence or assist some decision of the government.

**Senator Stanbury:** And your organization would apply some of its research and development energies toward finding practical methods of giving some processing to resources before they are exported?

**Dr. Keys:** Indeed, we would. As I mentioned, we have the Canada Centre for Mineral and Energy Technology, and

within that there is a group which I think over the years has established itself as a reasonable centre for physical metallurgy in Canada. It is quite a good one, actually, and is devoted to that type of secondary activity, if you wish, namely, processing.

**Senator Stanbury:** Then because you in a forthright way put forward your concerns in your initial statement, I wonder if we could get your suggestions as to what is needed to solve the problems. You talked about the problem of consistency, and I suppose that immediately means, in the minds of all of us, that there have been oscillations in support of some kind that you think have caused an inconsistency. What do you propose as a solution for that inconsistency? You talked about the need to have the best scientists, which sounds to me as though you feel that somehow or other we have not accomplished that. Then you say we have had severe problems with both money and people. What is your solution to that situation? It seems to me that you are raising some rather strong issues, but I did not catch any solutions. Here I am looking for advice, not opinions.

**Dr. Keys:** Your point is well taken, senator, and I am sure that if I did have the solutions to those questions, then I could possibly write my own ticket not only in terms of this country but in terms of other countries as well because we are not unique. My purpose in highlighting those things was to give you my concerns. I cannot give you the answer. And I am not sure if anybody can. I think I can tell you or find out for you who the good scientists are. We know. The science community knows. But you will not get a straight answer or the same answer from each of them.

On the question of the ups and downs and back and forths, I am not suggesting necessarily that this has happened in the past, but we are a resource limited country. I have to make that point in terms of our size. We are also resource limited in terms of our financial resources and therefore I would hope that as we go through these difficult times the question of large cutbacks in scientific activities would be approached very cautiously. I think I did say at one time that I was against a suggestion that you should not put lots of resources in any more than you should take lots out but for totally different reasons. I was really making a plea for, if you want, some continuity. I am not suggesting that everybody should be allowed to do their own thing for as long as they want. I do not think any one of us can. I am suggesting that for those things that the government has decided are important, we should try to see them through unless there is a rationale for not doing so. But having said that, I recognize that this is a country—it is not just science. There are many, many policies that govern this country, and there is no use my pretending, or anyone else in a science operation, that we exist in isolation. There are other things that are important to the people of Canada—all the social aspects, and science can contribute to that.

We can contribute in a number of ways. We may be asked to contribute in the future by shifting some of our operations. Mr. Chrétien has made a public announcement about the government's intention to relocate and science may be called upon to participate. That may or may not help science, but in the government's opinion they will relocate if it helps Canada as a whole. I guess I am just cautioning against precipitous actions that could run things up and down.



**The Chairman:** But once you are faced with a fire, instead of moving people who are working on what you believe to be important problems, why don't you contract out and get an outside fire brigade to fight your fire instead of moving people from their actual work?

**Dr. Keys:** I would love to, Mr. Chairman, and I think my colleagues would too. We would dearly love to do that.

**The Chairman:** Has it been tried?

**Dr. Keys:** We do contract out work. I think you have the figures in the brief we gave to you for the kinds of things that are contracted out. I could give an interesting example, and this is perhaps indicative of what we have to do in Canada. When the Beaufort Sea study had to be made, and there was a multimillion dollar study before that could go forward, who did the work? Who paid for it? It was paid for by industry and done by government scientists. Why? Because we are a small country.

**Senator Yuzyk:** And it was in the national interest.

**Dr. Keys:** Yes, but industry itself did not have the people to do it. And we are a small country. The universities contributed, but can you denude a university department for a year or two years in order to do a study like this? We have not been successful in doing so, and I am not sure that we should be. The point I am making is that we are a resource limited country and we should be thinking of consolidating resources for this type of activity. I think that is a very good example of where industry and government worked together. I am told by some of my scientific colleagues that one of the unfortunate things is that that work stopped. We are not going ahead any more. We have the data base that we think we need.

But again I go back to what I think has to be the solution in this country, and that is not just doing it in house and not just doing it in the private sector and not just doing it in other public sectors, but doing it together. We just do not have the resources to do it any other way.

**The Chairman:** You mean that in your own areas of interest we have a great scarcity of professionals in Canada?

**Dr. Keys:** Well, we have problems. In some areas in which I am associated we do have a scarcity.

**The Chairman:** Because we know there are surpluses in other areas.

**Dr. Keys:** There may be, and in particular areas there have been. I do not want to preach, but we go back to the mid-1950s, which is a bit before my time on the scene. I recall the stories I had heard about that time where what would have been my colleagues in the Mines Branch, now the Canada Centre for Mineral and Energy Technology made a plea for work on coal, and they had a great deal of difficulty persuading the people who allocate resources that coal was important to Canada. The people in charge of the Mines Branch at that time stood firm and insisted that work be continued on coal. I can assure you that if they had not been successful, this country would be in a very dire situation in terms of the future outlook for energy. In fact, I am not convinced that we are not in some kind of trouble now simply because over the years we have not seen fit or we have not been able to allocate people to those fundamental things we should be doing. I worry when five people leave the Department of Energy, Mines and Resources.

**Senator Stanbury:** Mr. Chairman, I wonder if this is not what we are saying—and it seems to me that this is something that came out this morning as well—that it is not so much a shortage of excellent, trained personnel, people who know these fields, as much as it is a shortage of the institutional utilization of these people. In other words, the government can employ so many geologists but it cannot employ everybody. It is not desirable and they do not have either the budget or the functions to do so. But other than universities which employ them as professors, there is not a sufficient number of other institutions who have as a business or as a responsibility the development of that kind of research and that kind of knowledge and that kind of commercial activity to utilize a sufficient number of these expert people to accomplish the task of getting a knowledge of the infrastructure which you have to have before you can go ahead and solve these problems.

**Dr. Keys:** When one is talking about matters pertaining to a geoscience—and I am including geology and geophysics in that—one finds that the private sector does hire people to do seismic work and it does hire geologists to do interpretations. Occasionally we even get one back in the federal government, for one reason or another. By and large, that is the area in which those people can find an existence. The type of geologist who is adept and skilled at predicting, if you wish, what resources lie underneath the ground may be a different kind of geologist from one who is skilled at predicting and delineating the structures, the tectonic structures in which these resources are found. I do not know whether that is clear. There is a difference. In other words, there are geologists, and some are good bedrock geologists and some are good resource appraisers.

The problem is that we have a very special situation which may arise in the near future, which I hope my minister will be able to announce, which requires scientific and technological expertise within the department. When we look to see where to find that scientific and technological expertise, I am told that there are two people.

**Senator Stanbury:** In the country?

**Dr. Keys:** In my department. I am told that there is another man outside the department, who has been identified. But that makes me shudder, because if those people disappear for some reason or another what is going to happen to that technological area? I would be very pleased to tell you what that is when my minister makes the announcement; I will specify for you, if you wish, that particular area. That is what frightens me.

**The Chairman:** We should declare them as national property.

**Dr. Keys:** But they may die. One of them is at retirement age.

**Senator Lang:** I recall that in 1960 we could not get graduates to go into mining or geology. We closed down the Faculty of Mining at the University of Toronto. Maybe that is where the root of the problem is. You are just experiencing it now 15 years later.

**Dr. Keys:** You are right. That was identified at that time. I can remember that studies were being undertaken by the then Mines Branch within the department that I am now in. They looked at who was in the mining schools and they were shocked; they found numbers of ten across the country, if my recollection is correct; there were very few.

**Senator Lang:** It was the "out" thing to do.

**Dr. Keys:** Yes. I would like to think that in bad times, when there are not many jobs in the private sector, one of the roles of the federal government is to take and use those graduates, and then when times are good in the private sector have those people go out and move into the private sector; in other words, act as some sort of ballast tank for good people.

**The Chairman:** We are told that once they have joined the civil service they cannot move out any more.

**Dr. Keys:** Don't you think we could fix that in some way?

**Senator Godfrey:** I was going to say the same thing as Senator Lang. I vividly recall, when I was director of some mining companies about that time, my own feeling was that the mining companies themselves were not paying mining engineers a great deal; they were spending six months in the bush away from their families, and it just was not an attractive profession. Has that improved at all?

**Dr. Keys:** In my judgment it has not.

**The Chairman:** Perhaps it was just a bad company.

**Senator Godfrey:** No, no. I am talking about competitive salaries. It did quite shock me when I discovered how much they were paying people, and I used to comment on it and said, "No wonder we are short of these people." However, that is just an aside.

I am completely puzzled by something in your brief, although not because of the use of initials. On page 62, at the bottom, you say:

Long established branches have the problem that the major portions of their operating funds are required for salaries. Thus while the Department as a whole is spending about 13% of its R&D budget and 16% of its RSA budget extramurally, these percentages would be much higher (40% or more) if the effect of salaries were removed.

I cannot follow that at all. I have one more comment on that sentence, when I look at that 40 per cent which you say you did not take in salaries. I compare that with the statement on page 53, where you say:

There is a steady increase in the percentage of R&D contract funds going to Canadian industry (40% in 1973-74 to 83% in 1976-77).

First of all, I cannot understand the thing about salaries. How do you reconcile the 40 per cent with the 83 per cent?

**Dr. Keys:** Let me try to tackle the first one first; that is, the question of the percentage of the funds spent on salaries. By a branch within the Science and Technology Sector you can imagine that that will be different. In the Canada Centre for Mining and Energy and Mineral Technology, if I take the salaries as a percentage of the total budget of that particular group—in other words they get so many dollars per year—the salaries in that group account for 60 per cent, roughly.

**Senator Godfrey:** They are not doing any research development?

**Dr. Keys:** These are the salaries of the people. The other 40 per cent is for other things, such as buildings, equipment, stores, travel and all those things that go along with

a scientist, and also for buying work, or contracting out. That is in that particular item. Is that understandable?

**Senator Godfrey:** So far.

**Dr. Keys:** Just to give you the flavour of this, in the Geological Survey that figure is about 50 per cent, and the reason that it is different there is that they run field parties in the summertime; some of these field parties are up north, and that is an expensive proposition; a lot of money is spent on moving people and equipment into the field for their particular work. In the case of the Surveys and Mapping Branch it is also 69 per cent, 68.7 per cent, spent on salaries. So, it is very high.

**The Chairman:** It seems to me that you use this argument to illustrate your contracting-out policy. It would seem that when you contract out you have those who do the research who have to be paid salaries too.

**Dr. Keys:** Oh, yes. I was going to tackle that.

**Senator Godfrey:** I follow you so far, but I have not followed the conclusion.

**Dr. Keys:** I am just answering the question to try to illustrate. I know it is confusing; figures are always that. In the Earth Physics Branch the figure is 48 per cent on salaries, again because of the large number of expensive field parties. In the Canada Centre for Remote Sensing only 18 per cent is spent on salaries. There is a lot of money there, and we could talk about that, because that is mostly in industry. On the Polar Continental Shelf Project only 16 per cent is spent on salaries. Again the reason is not because they are big spenders but because they are a service operation; they fly aircraft in the north to provide service for other people who have to move around; there are only 22 people in the whole operation. In the office of Energy Conservation the figure is 15 per cent, because a lot of their work is contract work and information activities. Again we are going back to what we talked about earlier attempting to tell people in this country what we have to do in conservation. For the Office of Energy R&D it is 76 per cent, because they are mostly people; they have very little money at their disposal for contracting out. I have tried to give you a flavour of how much of the funds available to each of these branches is tied up in salaries. Does that answer that part of your question?

**Senator Godfrey:** I could have answered that part before you started. I do not follow the next jump. Surely if you contract out you could reduce salaries.

**Senator Lang:** No. You cannot fire anybody. Have you forgotten?

**Senator Godfrey:** That comes a little later. You are talking about an R&D budget. Part of it can be spent on salaries and part of it on other things. If you contract out you have less salaries, as you point out on page 64. You say you cannot disturb that, that you do not want to have mass firings, and so on. I just do not follow the logic of that sentence, because eventually the more you contract out the less salaries you will have, because there will be fewer people on staff that you would be needing to do R&D. Surely it is all part the percentage of a budget.

**Dr. Keys:** I think Senator Lang put his finger on it. We have people on staff; there are people there. If you contract out the totality of the cost, which includes the cost of salaries, what are you going to do with the people?



**Senator Godfrey:** You did not have much concern about the people at universities when you cut them down in order to give more to industry.

**Dr. Keys:** My department? Me?

**Senator Godfrey:** Yes, that is what you say.

**Dr. Keys:** In the case of a university, the salary is paid for by the university. The individual is a member of the university staff, so he is assured of a job. Most of them have tenure, I imagine, in the university. The funds that are moved into the university from this public sector by and large do not pay for the university salaries. They pay for the work, and perhaps some of the students and fellows who work with them.

**Senator Godfrey:** But at page 53 you say:

There is a steady increase in the percentage of R&D contract funds going to Canadian industry—

That is where you mention 40 per cent and 83 per cent. It continues:

This has been accompanied by a decline in percentage R&D contract funds to universities.

So, in effect, you are taking something away from the universities, whether it is research assistance or something else.

**Dr. Niblett:** But the grants to the universities have gone up; the contracted work has gone down. That is right; that is what the figures show.

**Senator Godfrey:** That is not what you say at the bottom of page 53.

**The Chairman:** It is since 1973-74.

**Dr. Niblett:** Yes.

**The Chairman:** Those are not the figures I have. At least the total support of other performers you are giving has declined since 1973-74, according to your figures. According to the figure I have, based on Statistics Canada figures, the 1975 survey, you devoted approximately \$4.2 million to the support, in terms of R&D of other performers, including \$2 million to industry. That is for 1975-76. In 1973-74 the total figure for support to outside performers was \$5.5 million, including \$3.9 million to industry. So that there must have been a decline, not only in the total but also for universities.

**Senator Godfrey:** I cannot understand your statement in view of the last sentence on page 53.

**Dr. Niblett:** Do you mean with respect to grants?

**Senator Godfrey:** Yes. It says contract funds as opposed to grants.

**The Chairman:** Speaking about total support, including grants and contracts, but total support in terms of grants and contracts has gone down.

**Dr. Keys:** I wonder, senator, if perhaps we should look at page 58 of the brief. Table IV indicates the disposition of extramural R&D expenditures. I believe that is what we are discussing. We see them broken into two sections in the table, under R&D contracts and down below that R&D grants. We could take the year 1975-76, as one that has passed.

**The Chairman:** That is what I took.

**Dr. Keys:** When I look at the upper part of that I find that the R&D contracts amounted to roughly \$2.7 million, and the R&D grants, looking at the part below that, amounted to roughly \$1.6 million. The sum total of that is roughly \$4.4 million. Then I move back to the 1973-74 year and I come to approximately \$4.1 million, but I do notice some change in the percentages in terms of grants as a per cent of the total R&D. I am now looking at the figure at the bottom of the table, where 8.8 per cent in 1973-74 reduces to 4.7 per cent in 1975-76. Are we in trouble with figures again, senator?

**The Chairman:** I am quite sure we are. Are those the figures which you gave to Statistics Canada and which are provided to us through MOSST?

**Dr. Niblett:** Yes. These figures are based on information supplied by MOSST.

**The Chairman:** Because on the basis of the information which was made available to us, my total for 1973-74 was \$5.5 million. But we will not quarrel about that.

**Dr. Keys:** One of the big services that your committee could perform for the scientific community would be to see if these statistics can be regularized. I do not wish to belabour the point to which you have obviously been subjected, but I would point out that we have the same problems. We are invited to respond to a number of questionnaires and we would be delighted to have only one questionnaire.

**The Chairman:** The trouble is that we raised that question back in 1968, and Statistics Canada came before us and told us at that time that we were, through direct contact with departments and agencies, obtaining figures which were quite different from those which Statistics Canada was getting at that time, and, of course, we criticized that situation. As a result of our representation, an interdepartmental committee was created in 1969 or 1970, but here we are in 1976 still in the same mess.

**Dr. Keys:** And, senator, I have just responded on behalf of my department to a further survey which was requested in the spring in terms of northern expenditures. Again we have to go through a totally new exercise, because we cannot extract the figures from anything before us. When those are compared, I am sure there will be the same types of problems. I have another which just arrived, asking me to report on expenditures again. I hope that that will not be different from the previous one. However, if it is frustrating for you to look at these figures, it is equally frustrating for us in the department to produce them, because we would like to have the right figures also.

**The Chairman:** Do you have a representative on the interdepartmental committee?

**Dr. Keys:** Yes, we have always had a representative on the interdepartmental committee. I do not wish to complain about that interdepartmental committee, which is a MOSST committee on scientific expenditures. That committee has done an admirable job in trying to mesh the requirements of MOSST with the requirements of Statistics Canada. I have no quarrel with that one, but I do quarrel with the fact that we want to collect another set of statistics against another set of parameters and they just do not mesh.

**The Chairman:** Who is doing that?

**Dr. Keys:** That happens to be done again by the Minister of State for Science and Technology on behalf of the Department of Indian and Northern Affairs, of which committee, unfortunately, I am chairman. I have to wear that one for my sins. However, I do feel strongly and always have felt strongly about the need for good information, because decisions cannot be taken on bad information. Timely, accurate and complete information is needed. Those of us who are responsible for activities in the scientific and other communities have just as big a need for it. So our frustration is just as great as yours, but I do not control it.

**Senator Bell:** You have apples and oranges and they just do not add up.

**Dr. Keys:** Yes. In our department we have a plan, if we can take the money—and I suppose it will come out of my sector, unfortunately—to put in a financial information system, it will, I hope, match the program activity structure and contain those elements in a central computer so that when we are asked for statistics we will be able to punch the right button and produce your statistics. When MOSST asks for statistics, they will be one and the same.

I may say that many years ago, when I had a division and I foresaw the problems that were created with my colleagues in terms of how people like information, I went home one night with one of those punch cards and decided to fool the system by writing down all those things which I should know about each of my projects in the division and code them. Then, whenever I would be asked a question I could have the information there and it would be self-consistent. So I did this and came up with 88 different elements against which I would want to code each project. I took it to the minister and asked what he thought of this, whether it was not a good idea because I would not need a computer. He said, "You can do it if you wish, but the next question that you get will be number 89."

**The Chairman:** To whom should we address that recommendation? To MOSST?

**Dr. Keys:** I think MOSST might find it helpful and could be helpful to the rest of the departments if they could somehow or other bring these things into line. I cannot do it alone, and my colleagues in other departments cannot do it alone.

**Senator Stanbury:** If MOSST has the responsibility for co-ordinating these statistics and is doing it and then is asking you for some other base, it means that their original base or the ones that the interdepartmental committee is working on are not comprehensive.

**Dr. Keys:** It is difficult, senator, that is right. I do not wish to be critical of my colleagues in MOSST. It is a difficult situation, but it would be helpful if we could decide somehow or other.

**Senator Stanbury:** If MOSST should have responsibility for that, surely you should not be building a system within your department which is going to in some way compete or duplicate or surpass something MOSST should be doing.

**Dr. Keys:** That is quite right. The Department of Energy, Mines and Resources, of course, is a large department, of which the S&T component is just one. I am talking about a financial management system which is needed for the deputy minister and his total decision. I am expressing my hope that it will answer the questions that I think need to

be answered in science and technology. I was under the impression, Mr. Chairman, that you got the statistics on expenditures from MOSST.

**The Chairman:** That is the figure I quoted.

**Dr. Keys:** Then we really should rip these pages out.

**Senator Godfrey:** In line with what Senator Lang was saying with respect to people on staff, I was surprised to learn about your difficulty in diverting money as a result of reducing your staff to outside contracting. That is an incentive, in fact, to replace people, because if you do not replace them you cannot make that money available for the make-or-buy program. Have you made any real effort to get the Treasury Board to change that?

At the bottom of page 66 of your brief, you state:

The Canadian Centre for Mineral and Energy Technology wishes gradually to eliminate positions as they become vacant in order to free financial resources for contracting out R&D. However, present T.B. guidelines do not permit use of salary funds for those purposes.

That seems to be a rather ridiculous policy. What efforts have you made to make Treasury Board see the light of day, or is this an insurmountable difficulty? Is there some way in which we can help in that respect?

**Dr. Keys:** Each year at about this time, Senator Godfrey, when the estimates are called for by the Treasury Board, we can make whatever allocations we wish, within reasonable limits and compatible with what we have put forward in our program forecasts, between the various types of activities that we want to undertake. It can also be put on an "object-of-expenditure" basis, which, I believe, is the way Treasury Board does it and has done for some years. Once we have done that and we have put a salary dollar in, Treasury Board—and I would not want to challenge this—finds it necessary and desirable to control the expenditures of departments on manpower by controlling salaries. It also controls by man years. I think you are well aware of the abuses that could arise if there were no controls of that nature.

On the other hand, if there is a sufficient cause, and one can show that there is a cause for not filling positions, and it is desired to transfer that salary money to other purposes, a proposition in that regard can be submitted to Treasury Board. Treasury Board, to my knowledge, has never refused to listen to a proposition. So, that mechanism is available for changing what appears in the main estimates.

However, if a manager goes to Treasury Board every time he wants to divert \$15,000 or \$20,000 out of a vote of \$8 million or \$9 million, Treasury Board will simply tell him to find the \$15,000 or \$20,000 out of some other portion of the operation. It simply will not consider individual diversions of small amounts of \$15,000 or \$20,000. You simply cannot go before Treasury Board for a change in allocation every time someone resigns or retires.

**Senator Godfrey:** But it would add up over a period of years.

**Dr. Keys:** Yes, and a manager could decide that at the end of a fiscal year, not having filled five positions, to go before Treasury Board to have that \$100,000, or whatever the amount is, diverted to contracting out for the next fiscal year. I cannot prejudge what Treasury Board might



do in that situation, but certainly the mechanism is available to bring such applications.

**Senator Godfrey:** So it is not really as serious a problem as it would appear.

**Dr. Keys:** The main problem is that it ties the manager's hands. If he has \$20,000 as a result of a resignation or retirement, he cannot use it. However, in gross, it can be overcome. If, for instance, any part of government wished, for some reason, to run down its man years, I do not know what Treasury Board would do. I would guess at this stage in the game that it would be very happy to see those dollars saved, because the government needs to save as many dollars as it can. On the other hand, it might put them back into the S&T circuit by allowing those dollars to be diverted to contracting out.

In terms of my perception of the Treasury Board, it will look with more favour on dollars spent outside rather than enriching internal activities. Even on that basis, one can only go so far, because if there is no one doing the work internally to complement what is being achieved through contracting out, there would be difficulties.

**Senator Godfrey:** Yes, you make that point, and I agree. I can understand your not wanting to have wholesale firings, but surely there could be some kind of mechanism by which you could divert salary dollars to other areas.

**Dr. Keys:** To give you an example, either as a result of retirement or death, my job will become vacant some day. What do you do then? Do you fill that vacancy or not?

One looks at each position that becomes vacant with a view to how essential it is in the structure of getting the job done. The last thing I want to see happen in this country is that the clerks and secretaries get fired. Clerks and secretaries are easier to replace than some of the management people. The last thing I want to see this government do, in looking for savings in man years and dollars, is to start picking on the clerks and secretaries. I think that would be a mistake, and I hope you agree.

**Senator Godfrey:** I have not really thought about that problem, so I will not pass any opinion.

At page 26 of your brief you say:

The creation of units working in French has not improved the efficiency of scientific research and related activities.

Then at page 27 you say:

The identification and fulfillment of language requirements has increased the difficulty of satisfactory recruitment.

And at page 32 you say:

There are a number of external pressures and political priorities that may require organizational changes within the branches. The foremost of these concern decentralization and units working in French.

Is this a real problem or not? You hear all kinds of allegations made by the public in this respect.

**Dr. Keys:** You could probably get any answer you want, depending on who you ask. Some people look upon the opportunity of learning a second language as a very positive step. It enriches one's ability to communicate; it enriches the literature that you can comprehend, your appreciation of the arts, and so forth. Some people hold that view. I am equally certain that other people, who

perhaps do not have the facility for picking up a second language, view it as a threat. If you view the requirement to learn a second language as a threat to a career you started 10 or 15 years ago, a career which you thought you had some hope of progressing in, then, not surprisingly, the tendency is to be concerned about it.

In that context, in respect of those individuals, I would guess it constitutes a morale problem. In respect of the difficulty in attracting people, I cannot, of my own knowledge, pinpoint a difficulty. They are being asked to learn a second language. I cannot see that that is any more difficult—in my experience, it may be even less difficult—than attracting francophones into the public service in the past. There have been difficulties in bringing people with francophone backgrounds into an anglophone environment, so I suspect that it happens in both ethnic groups. But there is certainly the question of training in another language, whichever one it happens to be, of hiring someone in a bilingual position and immediately sending him off for six or eight months' training, or something like that, in another language, and that puts a strain on the system.

We have one issue in front of us right now; in fact, it is tied up with this. You want to see one of these publications next year? You may not see one next year because the man who can do that may well be away. It could be in English or it could be in French, but in that sense, perhaps that is the price we have to pay in this country. I am not going to argue that; that is not my decision; it is a political decision; and if that is part of being a Canadian that is part of being a Canadian, but that is the context in which—

**The Chairman:** What do you mean in relation to "this"?

**Dr. Keys:** Well, we need people who can do the analysis in order to provide the necessary information to produce these publications. In this particular case it is possible that the person expected to do this for the next round will be on language training, and we do not have the flexibility to fill in behind. I am not sure what percentage of our positions at any one time in the department are taken up in language training, but I suspect it is significant.

**Senator Godfrey:** Well, from this statement that the creation of units working in French has not improved the efficiency of scientific research and related activities, I get the impression there that you are suggesting—

**The Chairman:** It is the understatement!

**Senator Godfrey:** It has gone the other way; it has decreased. I can understand what you have just said, but have you actual experience with units working in French? Have you created units where you do not have the same efficiency, or is it because people are taken away to learn French after you have created the units?

**The Chairman:** How many French units do you have?

**Dr. Keys:** We have a number of small units, we have two major units designated in response to the government policy, which I guess is in some sort of a hold mode at the present time, suggesting that there should be major units working in French. We have one in the Canada Centre for Mining and Mineral Energy Technology, and one in the Surveys and Mapping Branch working in French. I think it puts a strain on the system of the type I mentioned. The ultimate effect of this has yet to be realized. I am not sure about inefficiencies when looking at the long term, but there are bound to be inefficiencies in the short term. The question of communicating between anglophone and fran-



cophone, neither of whom speaks the other language perfectly and yet are working in one of those languages, is not easy, and I am sure that the federal government feels this way too. What they are looking at is not the immediate but the long-term implications, and that may be fair enough. I think the jury is not in on that one yet. I would not want you to think that this statement indicates any conviction on our part that they are major or long-term problems. I think there is a short-term one, the nature of which I mentioned. The long term I do not know, and I am sure nobody else does either.

**Senator Yuzyk:** Can we focus now for a few minutes on a very important, unlimited, inexhaustible, renewable, permanent and perpetual source which, from the point of view of pollution, is considered to be a clean source?

**The Chairman:** Perhaps it is not a good source.

**Senator Yuzyk:** Well, this is what I want to inquire about. And which, because of the exhaustibility of our non-renewable resources, we owe to the next generation. That is solar energy. Now, how much emphasis does your department place on the study and the application of solar energy?

**Dr. Keys:** At the policy level in our department I think we recognize that solar energy has a role to play. Within the science and technology sector we have not the expertise which exists in other departments of the federal government in order to do the research and development or to carry the research and development through that may be needed in the future to better utilize that particular source of energy.

I am sure you have heard from Dr. Schneider, of the National Research Council, that they have a substantial effort on solar energy, the research and development and new methods of looking at solar energy. Central Mortgage and Housing has demonstration projects, and they would wish to carry out more, demonstrating existing technology to see what it can do in terms of backing off some of the other renewable or non-renewable energy sources.

The question as to how big a role they can play in the future is, I think, debatable but not whether they can play a role. There are essentially two ways in which you can capture solar energy at the present time: one is through direct conversion of solar energy into electricity through some conductor-type devices. The estimate on that cost-benefit at the present time is not promising, simply because the energy cost of making the device is very high. The other way involves heating effects, the low temperature effects, if you wish, or the use of low temperature heat as a collector with, say, reflectors and things of this nature. These are the types of solar energy that are being attempted and being used in various buildings throughout the country now. You are just as aware as I am of the demonstration buildings in the Toronto and Hamilton areas. The department in a policy sense is conscious of the role it can play, but I would want to emphasize that it will not be a total role. In other words it will not back off all the other renewable resources. I think that one can say fairly safely that that is the case. On the other hand, it certainly will contribute in some areas knowing that that little bit will help back off the resources. I do not know what the most recent estimates are, but if it does back off more than 5 or 10 per cent in the next 25 years I will be a bit surprised.

**Senator Yuzyk:** Anyway, you are making preparations for the future.

**Senator Bell:** Do you know anything about what other countries are doing in regard to this?

**Dr. Keys:** Yes, senator, indeed we do. Our office of energy conservation, for instance—this being one of the areas of particular interest to them—is in close contact with the work being done in the United States. The work being done there, of course, greatly transcends the work being done in Canada. There are many reasons for this, only one of which is that they have more money to spend on it. The other is that the climatic conditions are sufficiently different in that they get more sun. The hope is that it can displace something else which is greater, whether it be air-conditioning or heating.

I had the good fortune or otherwise to visit an institute in Task kent in the Soviet Union 15 years ago. It had a whole group devoted to the application of solar energy for those arid regions that lie in that lower part of the Soviet Union. They have been in this field for a long time.

**Senator Yuzyk:** And later this could be transferred to other areas. Is that right? This leads me to the other question which I think is very important and which we have not discussed at all, and that is your working relations with MOSST and how much MOSST is really co-ordinating or integrating some of these activities which cut across various departments in which your department is also a participant or may even play a leading role.

**Dr. Keys:** Perhaps I could take that in two parts, senator. For the first part the example I would give is Energy R&D. That particular activity was set up several years ago by my department, and the chairmanship and responsibility for reporting to Treasury Board and to the government lies with my minister. MOSST participates in the discussions that lead to the decisions, but the actual deciding and proposing and carrying out of decisions on the projects is left in the line departments. But MOSST, of course, in its role as science adviser to Treasury Board has an opportunity, presumably, at some stage in the process of commenting on whether the job has been well done and of making a particular assessment.

**Senator Yuzyk:** You have a regular mechanism for working with MOSST?

**Dr. Keys:** Yes, in that sense we do.

**The Chairman:** Before you go on, senator, would you permit me to ask a question about this energy R&D program? Back in 1970 and again in 1972 in our reports we noted that in several areas where several departments were concerned there was no effective co-ordination of their research efforts. Then, if my dates are correct, it took the energy crisis and the Middle East for the government to realize that in the field of energy there was no co-ordination, and a cabinet document was produced at the beginning of 1974, I think, to set up a task force to co-ordinate. The task force reported in April 1975 to cabinet, and cabinet went back to the task force and said, "Well, go back and do your work. There is no priority in the shopping list that you have provided." I understand that it was only at the end of 1975, or perhaps in 1976, that that shopping list was produced. So, it took two years to provide the priorities. That was six or seven years after we had noted this lack of co-ordination, and what was produced at the end of all this was an R&D program which I understand amounts to about nine to \$10 million.

**Dr. Keys:** Last year's program, senator?

**The Chairman:** Yes.

**Dr. Keys:** That is correct.

**The Chairman:** It was announced recently by your minister.

**Dr. Keys:** The increase in energy R&D was about \$10 million.

**The Chairman:** But why did it take so much time to get these people together?

**Dr. Keys:** Well, Mr. Chairman, you have been having these hearings and you have heard a lot of us talk. I am sure you have got a lot of different flavours of the way in which we do our business, and I am afraid I can only respond to you that if you want to get a job done you look first to people and secondly to mechanisms. You put the right people together and I don't care what the structure is the right people will get the job done. But if you do not have the right people, you can put all the structures in the world together and it still will not happen. I am as guilty as the next person in terms of what I perceive to be my responsibility to my government, to my minister and to my colleagues, but put me against somebody else and there is always a give and take. I do not think I want to apologize for the time it takes.

I think we are doing it better now, Mr. Chairman. We have been through the exercise and we are in the process of digesting it, and I expect that by some time in September we will have the second one. That one has not been nearly as painful as the first. I would like to use this as an example, because once it is going I think what you would like to see happen will happen. We now have, I think, all the energy R&D projects carried out in the federal government. We know them. We have them on big sheets of paper and we know the dollars and man-years and what they are trying to do. There are 240 of them.

**The Chairman:** Since when do you know this?

**Dr. Keys:** That information was given to me about three days ago. You should be happy about that. I think it was within the office of Energy R&D. We asked them what they could produce in the way of information that might be of interest to you and, as I say, I now can tell you that we do have that list. I suspect it is one of the few areas where we have gone across the departments in an area of national concern and we now have a handle on the R&D. As to what we do with it, the next time around you can ask us about that.

**The Chairman:** I hope you have agreed on figures.

**Dr. Keys:** Yes, Mr. Chairman, because there is only one source.

**Senator Yuzyk:** We are glad to hear that MOSST is able to achieve some of its objectives, although probably not totally, and I understand that you have a good working relationship with MOSST.

**Dr. Keys:** Yes. Could I just amplify a little, senator, because I tried to divide your question into two parts? The second example I would like to give is one where MOSST has taken the leadership, and that is in the area of co-ordinating Canada's ocean interests. MOSST has set up a committee to do that. I hope that that committee will be as successful as the committee set up by my predecessors in the Department of Energy, Mines and Resources in bring-

ing to the government's attention those things which should be done and need to be done in order to achieve what Canada wants to achieve in respect of ocean management. MOSST has taken that role, and as far as I know it is being carried out very successfully.

**Senator Yuzyk:** Without obstacles?

**Dr. Keys:** As far as I know.

**Senator Yuzyk:** Major obstacles?

**Dr. Keys:** It is people, senator. I do not care where they are. There are a dozen people, and those dozen people will get the jobs. I do not care whether it is Energy, Mines and Resources, MOSST or where it is.

**The Chairman:** Do you submit your estimates directly to Treasury Board or to MOSST prior to sending them to Treasury Board?

**Dr. Keys:** I apologize, because I have not been through, with my present department, the program forecast, but my understanding is that from our program forecast which goes to Treasury Board we would break out the science and technology component and pass that on.

**The Chairman:** You have not done that yet?

**Dr. Keys:** I personally have not. That is my understanding of what we will do. If it does not go that route, it will go to Treasury Board and I feel quite competent Treasury Board will send it back to MOSST.

**Senator Yuzyk:** EMR is very much information-conscious and information-oriented; there is no doubt about that. My question is this. We are now reading about the demise of Information Canada. I should like to find out from your department whether you have made good use of Information Canada to the extent that you will be sorry it is passing off the scene.

**Dr. Keys:** We had used Information Canada as a distribution centre for publications that come out from the department. I think the particular issue there that I guess has to be faced by my colleagues is the question of map distribution. Information Canada has been acting as a distributor for maps produced in the Surveys and Mapping Branch. Mr. Moore, the Director General of that branch, is making arrangements now with other outlets throughout the country to distribute the maps. I suspect that we are neutral on Information Canada as an outlet. I know of no complaint against it myself, so I cannot feel it was an inhibiting centre as far as any activities were concerned.

**Senator Yuzyk:** Has it now increased your load on information services that you will have to provide?

**Dr. Keys:** Perhaps not quite. Are you thinking of public information or scientific and technical information?

**Senator Yuzyk:** Both really.

**Dr. Keys:** The information on the land, Canada, which I will call the scientific and technical information, we will disseminate through other vehicles. We will have arrangements with private or provincial agencies to distribute those. I think we can handle that one all right, and it will not create a greater load for us. In the case of public information, informing the public of what it is our department is all about, we do of course have an information service, public relations if you want.



**Senator Lapointe:** Did you have much to say about the creation of PetroCan?

**Dr. Keys:** Are you asking me personally? I can duck that very easily. The answer is no. That is simply because I was not at the department when it was created. That may be dodging your question.

**Senator Lapointe:** Yes.

**Dr. Keys:** I am sorry that it is. If you are asking me whether the science and technology sector had any impact on it, I will have to pass that; I just don't know.

**Senator Lapointe:** Your department did not have anything to do with it?

**Dr. Keys:** The department I think did. What I am saying is that I cannot really speak for my Deputy Minister in this policy area. I can only really speak about the science and technology area.

**Senator Buckwold:** I want to talk about what you list in your submission as an international energy agency. What kind of international co-operation is going on with respect to R&D projects which are being undertaken by a wide variety of nations? Perhaps you could give us a short resume. Is every nation going off on its own study of solar heat and a variety of other sources of energy? Are we duplicating ourselves? I do not ask the question from the point of view of cutting Canadian expenditures, because I know this is a fundamental venture.

**Dr. Keys:** Senator, the quick answer to your question is yes, we have one man. He is actually attached to my office. I am ready to say that I do not believe in having a lot of staff; people would rather have it done by the line managers. However, I have one colleague attached to my office whose major preoccupation is with the international energy agency. He is Canada's representative or, at least, our department is essentially the federal government representative on this agency. He is just today turning in a report to that agency giving Canada's expenditures for the last three years, up to the present year, against a number of areas of concern in energy—other countries will also be contributing—with a view to putting together on an international basis a compilation of expenditures in these various areas so that each country will see what other countries are doing.

**Senator Buckwold:** Are doing, or are spending?

**Dr. Keys:** That is right. In terms of how the resources are being used. Then the sequel to that, of course, is that if we are spending on fossil fuels, on conventional oil, so many billion dollars in the world, the big spenders are these, then the natural sequel is to put those people together in some juxtaposition so that each can find out what the other is doing. That is on a global basis.

On a bilateral basis, both this man and others in the department are in close contact with their colleagues in the United States. The visits that they have made and the workshops down there have given us good insights into what research and development is being done in the United States. I can give you one example of this, which is coal gasification, but there are a number of very expensive demonstration projects which the United States is trying now. They will not be ready for some years, but through our co-operation there I would expect that we would save ourselves some hundreds of millions of dollars. In fact, we might get something which we would not otherwise get, or

be able to afford, because this technology will be developed in the United States. Whether they will get an equivalent amount back from us in some other area is a moot point, which, perhaps, I should let them answer. But we can gain a lot.

Another area which you did not raise is fusion. This is a potential on the horizon and is an extraordinarily expensive area, which I am sure you have investigated. Canada just simply cannot afford to go totally into that. If we do decide and can find the resources to do it, I expect that part of the fusion activity will be devoted to sending people to other countries to work on their programs, with the expectation that if those programs come to pass, at least we will have a nucleus that we can bring the technology into Canada. Those are big examples and we are talking in billions of dollars. In my opinion the co-operation is good.

**Senator Buckwold:** We talk about solar energy as referred to by Senator Yuzyk. I would guess that almost every developed country in the world is doing something in this regard, and probably duplicating. Is there any real point in Canada as a nation, other than perhaps a few experimental projects as a demonstration program such as the Minister of State for Urban Affairs is carrying out under the urban demonstration program, trying to develop a program, or should we wait for the United States, Russia or someone else?

**Senator Bell:** Japan, Holland, France, Germany.

**Dr. Keys:** May I give you a trite answer, senator. If we have good people, the answer is yes.

**Senator Buckwold:** To wait?

**Dr. Keys:** No, to do it; if we have good people, do it.

**Senator Yuzyk:** I understand that you are sending your people to these various centres in the world?

**Dr. Keys:** Yes.

**Senator Yuzyk:** So we are on top of what is taking place, say, in the solar energy field?

**Dr. Keys:** I think apart from the areas in the energy field that might be classified, I can safely say that Canada is familiar with it. Perhaps some countries, for one reason or another, do not wish to tell us. In the open sense, I think Canada is well informed on what our high technology colleagues are doing. I do not think we are ill informed at all. If we are, then we are wasting a substantial amount of money in sending our representatives abroad.

**Senator Buckwold:** I was really thinking in terms of what we could do in Canada rather than sending people abroad. Would we be better advised to concentrate on one or two, or perhaps three, very significant programs that are meaningful to us as Canadians, things that we can do well, and leave the rest to other people?

**Dr. Keys:** You are asking me, in a sense, to look into the future and say whether or not the young man who is now in high school, who may turn out to be a good scientist in 10 years time, if the nurturing is right, should be backed. I would prefer to see this country back its good scientists. I feel we should give many scientists a chance, but back our good scientists as they mature. If our good scientists say that we should put money into solar energy, then let's try our darndest to put it in; if they feel we should put money

into gasification, then let's try to do so. If we listen to our good scientists, the chances of success, in my judgment, are much greater.

**The Chairman:** But surely there must be some kind of priority in terms of areas. As you said a few moments ago, Canada is a very large country with a relatively low density population. In view of that, surely we should be interested, perhaps more than any other country, in doing research in long distance transmission.

**Dr. Keys:** Yes, we should concentrate on transportation, of which that is one element.

**The Chairman:** Are we putting long distance transmission as a high priority item?

**Dr. Keys:** I am worried about the use of the word "priority," Mr. Chairman. If you are asking whether we are giving attention to it, the answer is "yes." The question of how we get energy from where the coal is, for instance, in the West to the East where the largest demand is, is paramount. Based on present technology, it cannot be done by way of transmission. To throw out a concept that is not new, it might in the future be moved by way of low temperature super-conducting lines. That is not economically feasible now, but at some point in the future someone may improve the technology to the extent where it might very well be an economical means of moving energy. If we can develop a super conductor with zero losses in transmission that operates at near room temperature, then the game is over. The energy would then be capable of being transmitted in a lossless manner, except for the losses at each end. The prospects of that are not good, but it has not been totally ruled out. So, it is worth some effort and it is worth having good men working on the bench to see whether or not something along those lines can be developed, either by themselves or by working in conjunction with their colleagues in other countries.

**The Chairman:** Senator Stanbury.

**Senator Stanbury:** We discussed this morning the way in which Canada's efforts in the atomic energy field developed, and we discussed one or two of the things that are being discussed internationally now in which Canada may be asked to do some particular aspect of the research. It seems to me that would be something that we could be doing in connection with fusion or solar energy, or some of these other alternatives, in the sense that in our international discussions, or in our bilateral discussions with the United States—and you suggested there might be a *quid pro quo* somewhere along the line—as a means of becoming part of this development rather than simply waiting for them to finish it off and then take advantage of it, or try to take advantage of it, or buy the technology, we should be involved in taking assignments of particular aspects of it and developing those. What is your reaction to that?

**Dr. Keys:** I agree with you 100 per cent. If I may take you out of the energy field for a moment and into the high technology space shuttle area, that is precisely what we are doing. The National Research Council, on behalf of the Canadian government, has undertaken to provide for the National Aeronautics and Space Agency an integral essential part of the space orbiter, and that whole activity is being contracted out to industry. So we are participating in that, and I am sure that Dr. Schneider mentioned that to you. That is clearly a model and there is no reason at all why we should not do the same thing in other fields.

**Senator Lang:** Dr. Schneider did not mention that the idea of our getting in on that came from the private sector.

**Dr. Keys:** Well, all the good ideas do not come out of the public service. But I think, to be fair, senator, that that is one where there was joint consultation. The final proposal came from the private sector, but only after about two years of consultation with the scientific people.

**Senator Lang:** Give credit where credit is due.

**Dr. Keys:** Yes, and I am glad to see the private sector doing that kind of thing.

**Senator Stanbury:** All I am suggesting is that this is in the energy field and that your department might well be initiating that kind of effort, for otherwise it sounds as though we are prepared to sit back and let the other fellows do all the work and expect to get the technology or pay for it, whereas we could be involved in it before.

**Dr. Keys:** We do have another level of government which is equally interested in these energy matters, and I would hope that my minister would have something to say in respect of co-operation with them some time in the not too distant future. We put people there, working in their environment, contributing our brains and our knowledge to the advancement of the American activities or the European activities—it does not matter which way you go. That is a possibility. Another way is for us to take an integral part in one particular area. I do not know whether any country in the energy field is going to put itself in a position of not having some kind of a watching brief at the very minimum on the potential for the future. I think that any of the advanced countries are going to look very carefully, and that is why there is a proposition to do a little bit of work in fusion.

**Senator Stanbury:** And that gives us the opportunity for a watching brief elsewhere.

**Dr. Keys:** That is right.

**Senator Yuzyk:** But we stand to lose some of these people once in a while. It just comes to my mind that the president of COMSAT is a former Canadian.

**Dr. Keys:** We have, senator, lost a number of Canadian people who have taken up residence and citizenship in the United States over the past 25 or 30 years.

**Senator Godfrey:** But it is a two-way street.

**Dr. Keys:** Well, we had Mr. Howe come to us, didn't we?

**Senator Godfrey:** There has been more of a brain drain from the States into Canada lately.

**Dr. Keys:** In the last five years, yes; that is quite right.

**The Chairman:** Will the figures that you received three days ago be made available?

**Dr. Keys:** As far as I am concerned I could read them into the record right now.

**The Chairman:** I think that might be useful. This is the first time since Confederation that we have had those figures.

**Senator Godfrey:** Why not just print it in the record?

**Dr. Keys:** I want to make sure that I get in what you would like to have in. What I have here is a breakdown. If



you wish I can submit it to you at a later date. But essentially what I have here is the number of programs and projects against each of the five main task areas identified in the energy R&D. I would be glad to provide this information to you on a cleaner sheet. You will see that the number of programs in those five task areas amount to 30. These are further broken down to a total of 240 projects, each project having a description of what it is trying to do and what resources are available. Each one of those is looked at each year in the process of this energy R&D. Of course, some will be enriched as time goes on and some will not be and some, I suppose, will turn out to be not very successful and will be dropped and will be replaced by others. I think that while you may wonder why it took so long to get going, it is in good shape now, Mr. Chairman.

**Senator Stanbury:** I have two short matters. It seems to me that that kind of information would be very useful to industry as well as to us; in other words, for industry to know the kinds of projects, provided they are not secret matters, so that they have a chance to tie in and take advantage of it.

The other thing I wanted to mention was this. When we talk about bilateral arrangements with people such as the United States or Europe and so on, I would not like us to overlook the possibility, if it is a possibility in your mind, of bilateral arrangements with smaller countries in the R&D field. I have mentioned Spain two or three times already, but from discussions in two or three of the southern European countries I have found that Spain, for instance, which has only 33 million people against our 22 million, has exactly the same R&D problems that we have. They have imported so much of it that they have produced very little of it themselves. They have difficulty in getting their own industry deeply into R&D. One of the matters they raised with me was whether there could not be areas of co-operation in R&D, whether the energy and mineral fields, and so on, lend themselves to this, whether our two countries lend themselves to this. I am not trying to make a judgment. I am simply saying that in addition to these relationships with major countries, the major producers, there may well be things in which we could work together with smaller countries towards a common effort, to make us more competitive and little more independent of the big ones.

**Dr. Keys:** Certainly I do not think that is ruled out at all, that type of co-operation. I guess most of us—maybe it is not unnatural—would like to get more than we give in terms of these co-operative exercises. I think we have been fairly lucky with our neighbour to the south in some areas; they have treated us fairly generously in this respect. I think also, through our external activities, we have demonstrated our willingness to engage in co-operative projects with other countries.

If I move outside my own area of operation at the moment and look to my sister department, the Department of the Environment, they have undertaken to do hydrographic work with Senegal. Senegal wanted some hydrographic work done and Canada provided the ship, took people on board, trained them. Of course, we got something out of that too. It was an experience for us, with some training on our part, some new information. Also, the Senegalese got some. I think that kind of thing can go on quite well. It is not just give; it is participation. I think that is a major element in doing business with anybody, to give them the self-esteem that they are contributing too.

**Senator Lang:** Can you give me any guess as to when the domestic price of oil in Canada will be equivalent to our export price?

**Dr. Keys:** Would you like to have my resignation along with it? If you don't want it, I am sure my minister would want it tomorrow.

**Senator Lang:** How many men does your department have in our embassy in Washington?

**Dr. Keys:** My department has none.

**Senator Yuzyk:** Do we have anybody who is in charge of scientific activities?

**Dr. Keys:** Mr. Macdonell.

**Senator Yuzyk:** This is in Washington?

**Dr. Keys:** Our science counsellor in Washington.

**Senator Lang:** We have energy people in the embassy. I thought they might come under your department.

**Dr. Keys:** I know of nobody from our department who is down there on a permanent basis.

**Senator Bell:** I have just one quick question taken off the top of the other 45 questions I have not asked. I go back to standards, not statistics. With respect to a standard resource appraisal, perhaps using the North American standard, I guess you would have to have the provinces co-operate. I am thinking of Alberta with its coal standard; there is a different standard of reporting; they have a lower cut-off rate. It is very difficult there to compare statistics. Would it not be a good idea for your department to pull the provinces together and have them follow the same standard?

**Dr. Keys:** Senator, in my judgment, one of the roles of our federal government is to ensure that we do not balkanize. Those areas which form the country as a whole should be looked at as a whole. Each one has its own particular area. Yes, it is something with which we are concerned, not only in the resource area but in other areas. With respect to mapping, for instance, some provinces produce their topographical maps in a different manner than we. We are working toward this, but it cannot be done by edict. It must be done by persuasion and logic.

**Senator Bell:** Co-operation.

**Dr. Keys:** Co-operation. That is the name of the game. Put two people together and there will be no problem.

**The Chairman:** What is MIROC, this new mining industry joint research organization? Is this a joint enterprise organized on an industry basis?

**Dr. Niblett:** I do not know about that.

**Dr. Keys:** What does it stand for?

**The Chairman:** It is MIROC; perhaps Mr. Pocock knows?

**Mr. Pocock:** I forget what the acronym stands for; it was announced about two months ago.

**Dr. Keys:** It was announced without benefit of my participation as an individual. Whether my predecessor had anything to do with it, I do not know. He did not leave word.



**The Chairman:** It is just a private organization.

**Mr. Pocock:** It is just a private company, an industry-formed organization for research.

**Dr. Keys:** I think that can be constructive without prejudicing what might take place, but I would look on that as a good step in moving toward that model which I thought might come to pass in the country in the next few years.

**Senator Godfrey:** Did you say an industry-wide organization has not told you about it?

**Dr. Keys:** Well, I am not very important, senator.

**Mr. Pocock:** I know it exists. I could find the name from the man from Noranda who is president of it.

**Dr. Keys:** It just may be that I am poorly informed, senator.

**Senator Godfrey:** I would like to know. Surely this is the type of thing that would be worked on with the federal government.

**Dr. Keys:** I would certainly not like to see any industry castigated for lack of information. I will return to my department and find out, because I feel sure that it would not have happened without the knowledge of my colleagues, if I am not sufficiently important to be brought into the picture.

**Senator Bell:** Pages 27 and 62 of the brief have to do with aerial survey and contracting out. I am particularly upset in connection with the Centre for Remote Sensing. It is stated:

...its ratio of in-house personnel to external participants is too low for effective interaction with industry. Its flying activities have recently been transferred from the Armed Services to industry.

Then, on the other hand, we have the private aerial survey people; what is it, photogrammatic services?

**Dr. Keys:** Are you referring to the Canadian Association of Aerial Surveyors?

**Senator Bell:** Yes, they will be upset.

**Dr. Keys:** Very much so.

**Senator Bell:** Because they have lost a lot. How do we reconcile page 27 with page 62?

**Dr. Keys:** I think they are possibly two different issues. The first one is that in the Canada Centre for Remote Sensing, in that portion half the people involved are industrial people and half are government people. When you get to that low a ratio, then you are not quite sure of whether the government people have enough expertise, if you wish, because we have a lot of administrative overheads and I suppose they do it really to pull together on this activity.

In respect of the unfortunate situation—and in my opinion it is terribly unfortunate—with the Canadian Association of Aerial Surveyors, it goes back to this chosen instrument to which I referred earlier on in the afternoon.

If you are going into an area where the federal government cannot really support everyone who would like to be supported, then you have to choose one. There is simply insufficient funds to support everyone who might want to be supported in a particular venture. At the time the choice was made, the Canadian association made its bid. It

wanted to be part of that, and I think rightly so. Unfortunately, the group that came forward with the proposition was not selected, and they are hurt. The industry is not doing as well as it had expected, and it therefore feels that the government, perhaps, is not doing what industry would like it to do in respect of the private sector.

I do not know how I can comment on that, except to say that if one is operating in the private sector on a competitive basis, one accepts the fact that there is a winner and a loser. However, when one is operating in an area where the government determines who in the private sector should be the chosen instrument, one perhaps feels somewhat upset at not being chosen.

That is the basis of the problem that the Canadian Association has with the Canada Centre for Remote Sensing. It is a difficult issue. It is something with which we are going to be faced again and again in this country as we move towards industry-government cooperation. Someone has to be chosen and someone rejected. The one chosen is laughing; the one not chosen is dissatisfied. It is one of those issues for which there is no answer. Yet, I do not feel we can dodge it.

From my point of view, provided that the selection process is fair, then I have to stand and let them castigate me if they feel I have made a bad judgment. If everyone feels I have made a bad judgment, then they will get someone else to do the job. That is the name of the game.

**Senator Buckwold:** Generally, do not these things equalize out over the group of companies that may be involved in that over a period of time they learn to develop their own expertise and manage to get contracts?

**Dr. Keys:** That has been the history, senator. What I was trying to highlight is what I see as the future in expensive, high technology areas. Once you choose the instrument, the expense of transferring to another company is something that cannot be borne lightly.

In the case of this association, it has grown over the years. There are now, I believe, 18 members of the association. There are half as many again who are not members of the association involved in aerial survey. To my knowledge, 28 companies would like to participate in the mapping operation.

**Senator Buckwold:** I was really referring to the fact that the companies not chosen learn to develop a different area of expertise.

**Dr. Keys:** If I were involved with that association, that is precisely what I would be looking to. I feel certain that there will be a role for it to play. Clearly, it is not the role it wishes to play now, but I think in the future there will be a role for it. Certainly, it is not going to be totally excluded.

**The Chairman:** Mr. St. Laurent, at the end of his career, by way of advice, told me that if I cannot make everyone equally happy, try to make them equally dissatisfied.

**Senator Godfrey:** I could make a comment about the present situation politically, but I will not.

**Senator Stanbury:** Mr. Chairman, I think that puts the emphasis very much in the same place as Dr. Mooradian put it this morning, that being as a socio-economic problem. Because of the technology involved, you have to guild something which is big and which leaves you almost no flexibility as to using anything else. As soon as you do

that, you get a concentration of corporate power, which another commission is talking about. It also means that you make the decision as to which people shall be big and encourage the proposition that the bigger they are the better they are. It means you are starting to make decisions in society which is saying, "These people shall be big and the bigger they are, the better they are, and these people shall be left to do all the other things that do not require the high technology and so on," and that is a very serious decision for a society to make.

**The Chairman:** Are there any further questions? There is just one last one as far as I am concerned. You mentioned in your brief that your earth science program is not really part of or does not really respond to your policy mission in the department. It is a broad service agency. On the other hand, you mention also that you are the prisoners of all kinds of interferences and inflexibilities in terms of staff and things like that, presumably under the Civil Service Commission. I wonder if this program, instead of being in a department, could be better carried out if it were assigned to an institute or a crown corporation where it would be free to organize its program and define its staff policies and working conditions.

**Dr. Keys:** You mean like the NRC?

**The Chairman:** More or less, since it does not respond, according to your statement, to a definite policy mission in the department.

**Dr. Keys:** Well, you are putting me in an awkward position. That is fair enough. But can I take issue with what has been said?

**The Chairman:** Yes.

**Dr. Keys:** I think that the department is responding in the sense that the earth science program is providing all the information, the basic information, upon which the resource appraisal is going forward. But having said that, to go back to the question of whether the earth sciences program would be better housed somewhere else. I worry a bit about that.

**The Chairman:** It could still be an integral part of the department but could operate under a different set-up.

**Dr. Keys:** I suppose one could look at the possibility of going back about 60 years to 1917 when a certain agency was created with a mandate to try to co-ordinate scientific activity and technology. It may be that the time has come in this country when that may come to pass. I do not know. Certainly, the customers for that program are not only within the department but throughout the country. I do not know how my colleagues would respond to a shift of home. I think that if one looked at the functions one would want to make sure that in making any shift one was not in fact shifting because of what appears to be a bogeyman but that it would mean real gains for the country.

**The Chairman:** Well, I am referring to what you say in the brief at page 11, that this program is difficult to administer because it is essentially technological and scientific in nature with little immediate impact at the political level and that it serves many governmental missions in contrast with MERP, which is mainly an EMR responsibility. That is what gave me this idea.

**Dr. Keys:** I think the truth of the matter is that the government and the country is in a difficult way for resources. We have seen it in the last 15 years in industry in this country that when times are very difficult they have had to close down their R&D. They have said, "Sorry, there is no use looking to the future because tomorrow we will be out of business." So we have to solve tomorrow's problems. And I really think that Canada is somewhat in that state at the present time. I know it is difficult. I guess we would all like to have increased resources, but everybody cannot get an increase. So, given the climate and the situation, it is difficult to respond to some of the things, and obviously those things that do not have immediate needs are obviously not going to get more money. I hope that the government will take a charitable view over the long term as best they can in supporting these activities. It is clear that they have not received much support in the past. It may be that for a year or two it will have to remain more or less in a level mode. But it is an interesting thought and I would not rule it out as an operational mode at all.

**The Chairman:** Since it is after 5.30, we will end on this hopeful note.

**Senator Yuzyk:** Before we adjourn, Mr. Chairman, I believe there is a motion in order regarding the statistics that were presented.

**The Chairman:** Well, I thought that Senator Godfrey had dealt with that. It is only one page.

**Senator Yuzyk:** If a motion is required, I make the motion that the statistics presented by Dr. Keys separately from the brief be included as an appendix to today's proceedings.

**Senator Buckwold:** That would include the uranium supply projection?

**Dr. Keys:** Yes.

**The Chairman:** Is that agreed?

**Hon. Senators:** Agreed.

**The Chairman:** On behalf of the members of the committee, I want to thank you very much indeed.

**Dr. Keys:** Thank you.

The committee adjourned.



APPENDIX "32"

BRIEF  
to the  
SENATE OF CANADA  
SPECIAL COMMITTEE ON SCIENCE POLICY

submitted by:

Department of Energy, Mines & Resources

January 1976



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Jan. 1, 1974 - October 15, 1975

## SECTION 2.1      ORGANIZATION

### Introduction

The Department of Energy, Mines and Resources submitted in November, 1968 a brief to the Senate of Canada Special Committee on Science Policy. Since then the Government Organization Act 1970, 1970-71, c. 42 transferred the responsibility of the Department of Energy, Mines and Resources relating to water research, management and conservation to the Department of the Environment. This resulted in the transfer of the Water Sector from EMR to the newly created DOE. Subsequently some internal recasting took place and additions were made to the organization of the Department.

### Present organizational structure

The Department now comprises three line sectors and two staff sectors. The line sectors consist of the Energy Policy Sector, the Mineral Development Sector and the Science and Technology Sector. The first two are relatively small, and are concerned primarily with the development and implementation of policy in their respective fields. The Science and Technology Sector, which is relatively large and which contains the larger branches of the Department, provides scientific and technical support to the other two sectors, and is the principal source within the Federal Government of geo-scientific and geographic information about Canada.

Two organizational charts follow which show 1) the Department as a whole along with the Crown Corporations and other agencies which report through the Minister; 2) the Science and Technology Sector.

There are two committees concerned with the management of the Department. The EMR Policy Committee is chaired by the Deputy Minister and includes the Assistant Deputy Ministers with the ADM (Planning and Evaluation) as Executive Secretary. This committee is primarily concerned with matters of national and governmental policy, but also deals with questions concerning

departmental management, especially where these are affected by policy considerations.

The Executive Committee is chaired by the Senior Assistant Deputy Minister and includes the Assistant Deputy Ministers, (with the ADM, Planning and Evaluation again acting as Executive Secretary) and the Chief Financial Officer. This committee deals with matters of managerial and administrative concern to the Department as a whole; i.e. program planning and resource allocation, manpower planning, TB directives related to federal systems and procedures, internal management and administrative policies and matters passed from the Policy Committee.

#### External committees

The Department sponsors a number of external committees which have a wide range of functions.

1. National advisory bodies to groups of disciplines across Canada promoting development through discussion by appointed representatives, through annual review of research activities, through sponsoring of workshops and fora, and through advice on research grants.
2. National advisory bodies to the Minister of EMR as to the role of his department in national affairs and as to its scientific activities in relation to the departmental mission.
3. National coordinating bodies to harmonize federal and provincial activities.

Some of the above functions are still being fulfilled by the National Advisory Committee on Control Surveys and Mapping, the National Advisory Committee on Mining and Metallurgical Research, and the Canadian Advisory Committee on Remote Sensing. However, the Associate Committee on Geodesy and Geophysics of NRC and the National Advisory Committee on Research in the Geological Sciences formerly sponsored by EMR, have recently terminated their activities. This has taken place because of the prevailing opinion that scientific societies provide better and more democratic forums to promote development of scientific disciplines and to foster international participation

by Canadian scientists. The Canadian Geoscience Council, under contract to EMR is now producing a yearly review with commentaries on the status of geoscience in Canada. Further, that Council is advising EMR on the membership of an Earth Science Advisory Committee on the activities of the Geological Survey. In the discipline of research geophysics, the organization and sub-committee structure of the former Associate Committee on Geodesy and Geophysics has been transferred almost intact from the National Research Council to the Canadian Geophysical Union which is affiliated to two societies; the Canadian Association of Physicists and the Geological Association of Canada.

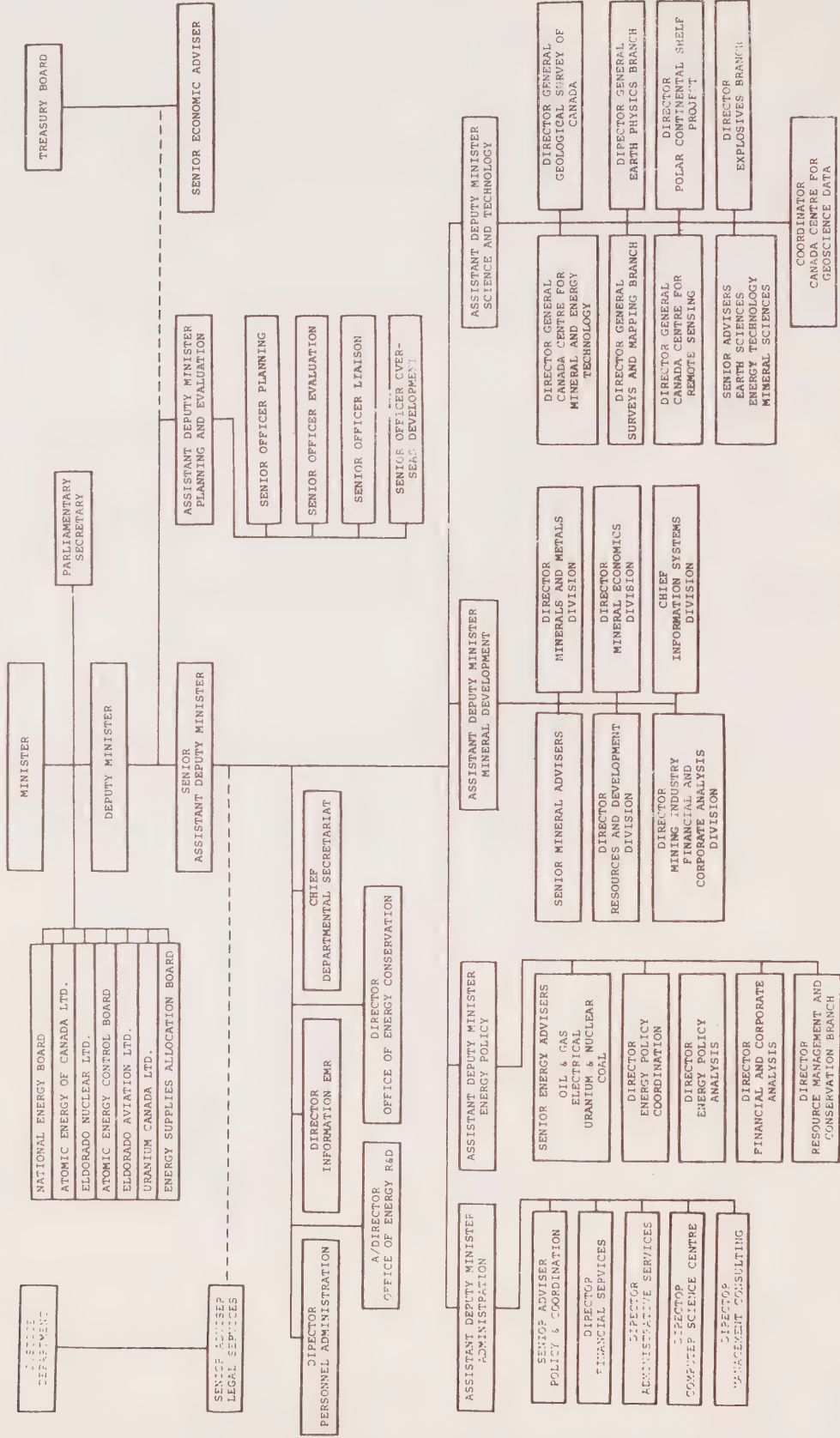
Overseas offices and formal agreements with agencies outside of Canada

EMR has no overseas offices dealing with scientific affairs. Its overseas representation is achieved either through special EMR delegations, or more permanently through the Department of External Affairs and the Department of Industry, Trade and Commerce and their attachés.

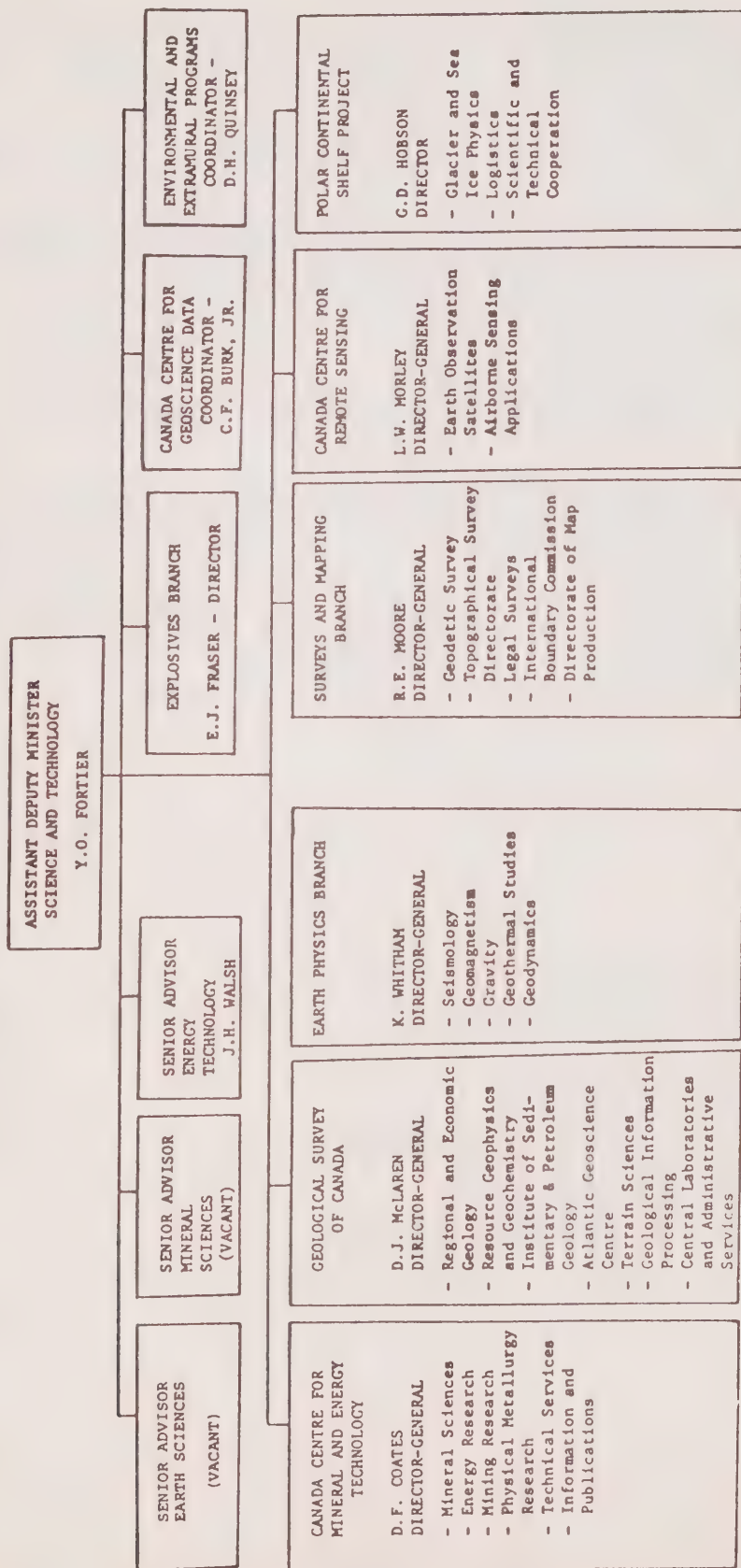
Although the Department is not the sole Canadian signatory to any bilateral or multilateral government agreements, it is co-signatory at least with DEA to a number of such agreements and acts as principal agent in the implementation of some. The Department participates in the formal bilateral scientific agreements between Canada and the following countries: Federal Republic of Germany, USSR, France, Belgium and Japan.



ORGANIZATION CHART OF THE DEPARTMENT OF ENERGY, MINES AND RESOURCES



ORGANIZATION CHART OF THE SCIENCE & TECHNOLOGY SECTOR



## SECTION 2.2      ORGANIZATIONAL FUNCTIONS

### a) Statutory functions and powers regarding scientific activities.

The responsibilities of the Minister of Energy, Mines and Resources encompass the federal government's role in:

- a) the development, coordination, and implementation of policies and regulations concerning energy and mineral resources,
- b) the provision of information about the Canadian landmass and its use, as needed by other government agencies and by the nation at large for a wide variety of purposes,
- c) the conduct of research and surveys as required for (a) and (b),
- d) the provision of advice and services consistent with the expertise and other activities of the Ministry.

The following pages list the provisions of the Department of Energy, Mines and Resources Act and the Resources and Technical Surveys Act as well as a few of the more important statutes, rules and orders that are administered by the Ministry\*, place responsibilities on its components, or are used by it in carrying out its responsibilities.

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\* includes the following components:

- Department of Energy, Mines and Resources
- National Energy Board
- Atomic Energy Control Board
- Atomic Energy of Canada Limited
- Eldorado Nuclear Limited
- Eldorado Aviation Limited
- Uranium Canada Limited
- Energy Supplies Allocation Board

Consolidation of  
R.S., c. E-6 and  
1970-71-72, c. 42

An Act respecting the Department of Energy, Mines  
and Resources

1. This Act may be cited as the Department of Energy, Mines and Resources Act.
2. (1) There shall be a department of the Government of Canada called the Department of Energy, Mines and Resources over which the Minister of Energy, Mines and Resources appointed by commission under the Great Seal shall preside.  
(2) The Minister of Energy, Mines and Resources holds office during pleasure and has the management and direction of the Department of Energy, Mines and Resources.
3. The Governor in Council may appoint an officer called the Deputy Minister of Energy, Mines and Resources to be the deputy head of the Department of Energy, Mines and Resources and to hold office during pleasure.
4. The duties, powers and functions of the Minister of Energy, Mines and Resources extend to and include all matters over which the Parliament of Canada has jurisdiction, not by law assigned to any other department, branch or agency of the Government of Canada, relating to
  - (a) energy, including energy developed from water;
  - (b) mines and minerals and other non-renewable resources;
  - (c) technical surveys within the meaning of the Resources and Technical Surveys Act relating to any matter other than a matter to which the powers, duties and functions of the Minister of the Environment extend by law; and
  - (d) explosives.
5. The Minister of Energy, Mines and Resources shall, on or before the 31st day of January next following the end of each fiscal year or, if Parliament is not then sitting, on any of the first five days next thereafter that Parliament is sitting, submit to Parliament a report showing the operations of the Department of Energy, Mines and Resources for that fiscal year.



Consolidation of  
R.S., c. R-7 and  
1970-71-72, c.42

An Act respecting resources  
and technical surveys

1. This Act may be cited as the Resources and Technical Surveys Act.
2. In this Act
  - (a) "Department" means the Department of Energy, Mines and Resources;
  - (b) "Minister"
    - (i) with respect to technical surveys relating to any matter to which the powers, duties and functions of the Minister of the Environment extend by law, and any powers, duties and functions under this Act that relate to any such matter, means the Minister of the Environment, and
    - (ii) with respect to other technical surveys and all other powers, duties and functions under this Act, means the Minister of Energy, Mines and Resources; and
  - (c) "technical surveys" means geological, geophysical, geochemical, geographical, geodetic, topographical, hydrographic, oceanographic and meteorological surveys.
3. The Minister shall
  - (a) collect and publish full statistics of the mineral production and of the mining and metallurgical industries of Canada, and such data regarding the economic minerals of Canada as relate to the processes and activities connected with their utilization, and collect and preserve all available records of mines and mining works in Canada;
  - (b) make detailed investigations of mining camps and areas containing economic minerals or deposits of other economic substances, for the purpose of determining the mode of occurrence, and the economic minerals or other economic substances;
  - (c) make a full and scientific examination and survey of the geological structure and mineralogy of Canada;
  - (d) make such chemical, mechanical, metallurgical and other researches and investigations as are necessary or desirable to carry out the purposes and provisions of this Act and particularly to aid the mining and metallurgical industry of Canada;
  - (e) collect and prepare for exhibition such specimens of the different ores and associated rocks and minerals of Canada and other materials as are necessary to afford a knowledge of the geology and mineralogy and the mining and metallurgical resources and industries of Canada; and

- (f) prepare and publish such maps, plans, sections, diagrams and drawings as are necessary to illustrate and elucidate any reports of investigations and surveys made pursuant to this Act.
- 4. The Minister may, for the purpose of obtaining a basis for the representation of the mineral and mining resources and of the geographical and geological features of any part of Canada, cause such measurements, observations, investigations and physiographic, exploratory and reconnaissance surveys to be made as are necessary for or in connection with the preparation of maps, sketches, plans, sections or diagrams.
- 5. The Minister may cause distribution to be made of duplicate specimens to scientific, literary and educational institutions in Canada and other countries, and also authorize the distribution or sale of the publications, maps and other documents issued by the Department.
- 6. Subject to section 4 of the Department of Energy, Mines and Resources Act respecting the duties, powers and functions of the Minister in relation to matters mentioned in that section over which the Parliament of Canada has jurisdiction, the Minister shall be responsible for co-ordinating, promoting and recommending national policies and programs with respect to energy, mines and minerals, water and other resources, and in carrying out his responsibilities under this section, the Minister may
  - (a) conduct applied and basic research programs and investigations and economic studies in relation to such resources, and for that purpose maintain and operate research institutes, laboratories, observatories and other facilities for exploration and research related to the source, origin, properties, development or use of such resources; and
  - (b) study, keep under review and consider recommendations with respect to matters relating to the exploration for, or the production, recovery, manufacture, processing, transmission, transportation, distribution, sale, purchase, exchange or disposition of, any such resources and matters relating to the sources thereof within or outside Canada.
- 7. (1) In carrying out his responsibilities under section 6, the Minister may formulate plans for the conservation, development and use of the resources specified in that section and for research with respect thereto, and with the authority of the Governor-in-Council and in

co-operation with other departments, branches and agencies of the Government of Canada, provide for carrying out such plans.

- (2) In formulating and carrying out any plans under sub-section (1), the Minister may
  - (a) cooperate with the provinces and with municipalities; and
  - (b) with the approval of the Governor-in-Council, enter into agreements with the government of any province or any agency thereof respecting the carrying out of those plans.
- (3) In carrying out his duties and functions, the Minister may inaugurate conferences of representatives of producers, industry, the universities, labour and provincial and municipal authorities.

### Statutes

Canada Lands Surveys Act, R.S.C. 1970, c. L-5

Department of Energy, Mines and Resources Act, R.S.C. 1970,  
c. E-6, 1970-71, c. 42

Electoral Boundaries Readjustment Act, R.S.C. 1970, c. E-2

Explosives Act, R.S.C. 1970, c. E-15

Official Languages Act, R.S.C. 1970, c. 0-2

Resources and Technical Surveys Act, R.S.C. 1970, c. R-7  
1970-71, c. 42

### Regulations, Rules and Orders

Explosives Regulations

Ammonium Nitrate and Fuel Oil Order

Equipment Certification Fees Regulations

Canada Lands Surveys Examination Regulations

Tariff of Fees for Copies of Survey Documents

### Responsibility Centre

Explosives Branch

Explosives Branch

Canada Centre for Mineral  
and Energy Technology

Surveys and Mapping Branch

Surveys and Mapping Branch

b,f) Organization policies, functions and responsibilities

To discharge the above responsibilities, the Department has developed three programs: the Mineral and Energy Resources Programs (MERP), the Earth Science Services Program (ESSP) and the Administration Program. The functions of MERP include scientific activities and policy formulation, whereas those of ESSP are largely scientific.

The Earth Science Service Program (see Appendix 1) has as its objective: to ensure the availability of timely earth science information, technology and expertise for effective management of the Canadian landmass and its resources, for land use and demarcation, the development of primary industries, regional and urban development, transportation, telecommunications, defence and physical science research.

The program essentially constitutes a survey or stock-taking of the physical phenomena of the Canadian landmass and its offshore regions. The activities relate substantially to the Resources and Technical Surveys Act. The program is imperative in today's climate of increasing demands on Canada's natural resources and the environment, of greater land occupation in both settled and frontier regions, of increased exposure to natural or man-made hazards, and of conflicting interests in land use.

The ESSP program is difficult to administer because:

- it is essentially technological and scientific in nature with little immediate impact at the political level;
- it serves many governmental missions in contrast with MERP which is mainly an EMR responsibility;
- it aims at producing a knowledge inventory of the nation as a whole and requires implementation through long-term programs and goals;
- it requires constant up-dating to remain scientifically and technically relevant and productive, demanding of its directors and performers R&D capabilities and technological adaptability;



- it must compete for funds and manpower as a long-range scientific investment in Canada against problems of greater immediacy;
- it demands of its directors and performers staying powers to provide national services of prime scientific standard in a climate of opinion increasingly critical of 'science in government' or viewing scientific information on the land as non-productive;
- it requires compromise, adjustment and accommodation to satisfy the Canadian condition of divided political jurisdiction, of public service versus private enterprise, and of free scientific exploration versus dedication to specific missions.

The Mineral and Energy Resources Program (see Appendix 2) has as its objective: to ensure effective use of the mineral and energy resources available to Canada, for domestic purposes, the development of primary and secondary industries and regional urban development, with due regard for the effects of the program on employment, national integrity, international relations and natural and man-made environments.

The MERP program represents, both in the fields of minerals and energy, activities in socio-economic or human sciences, in natural sciences and technology, and in policy formulation and implementation. In contrast to ESSP, the latter activities are dictated substantially by the policy needs of MERP, either in their formulation or implementation. While some of these activities have long pre-dated the present Department, the motivation for them has altered in recent years. Formerly the accent was on development of resources, largely achieved by providing industry and other interested segments of the public with new exploration technology and geoscientific guidelines for prospecting; presently the concerns are more diversified and include supply and inventory of resources and long range prospectives, greater national benefits from resource exploitation, and greater contributions to regional economic development.

The immediate concern for energy supply and the long-range concern for overall resources have intensified dramatically in the past few years and have substantially altered the scientific orientation of MERP. These concerns have led to increased emphasis on technology of recording geo-scientific data and analysing them for resources assessment, on determination of regional and local guidelines to identify and assess resources, on the development of systems of technological information and forecasting, and the application of dynamic and other models to predict interactions between resource supplies and other social and economic concerns.

The program-activity structures for both ESSP and MERP are currently in the process of development. This process requires identifying main activities within each program (12 for ESSP and 8 for MERP), sub-activities within each activity, projects within each sub-activity, and work elements within each project. The activities and sub-activities define the main objectives of the program and are expected to remain viable for many years unless major changes in Department's responsibility for scientific activities occur. The projects identify the objectives and tasks of scientific groups and may be expected to change as work progresses and new project objectives emerge. The work elements define the tasks of individual scientists or small groups and will change substantially every year.

The ESSP program is in a fairly advanced stage of re-structuring and is described in detail in Appendix 1 down to the sub-activity level for all units (branches) within the S&T Sector and to the project level for the Earth Physics Branch. Appendix 1 also shows in matrix form the financial and man-year resources presently allocated to main program activities according to major responsibility centres within the Sector.

The program/activity structure for MERP is less developed at the present time but is being actively re-examined. Appendix 2 provides an outline of the activities and sub-activities of the Program along with the activity/sub-activity/project structure for its major responsibility centre, the Canada Centre for Mineral and Energy Technology.

- c) Responsibilities in relation to other Federal agencies, industry, education institutions, international representations, etc.

The provinces and EMR are currently engaged in a major effort to set up a national system of resource inventory and appraisal to meet present and future needs of the country as a whole and its various economic regions. The work includes identifying type and standard of data needed along with methods for their recording and storage, R&D to establish types of resource deposits and the guidelines and technological criteria needed to locate and identify them, and methods of analysis for resource evaluation and assessment. This is a scientifically demanding task urgently required to obtain a systematic basis for resource research in the national interest, to improve its effectiveness and to ensure adequate return for the large expenditures it will incur.

The recently formulated Federal Program on Energy R&D (see Appendix 3) provides a good example of EMR functional relations to other departments and of interdepartmental planning. This program was formulated after EMR published the first phase of a report entitled "An Energy Policy for Canada" and after the Science Council of Canada identified the national needs for R&D in energy.

Other departmental scientific and technological functions and responsibilities which relate to external Federal agencies, industry, educational institutions and the public are best exemplified by activities of the various branches.

The Surveys and Mapping Branch is concerned with:

- establishing and maintaining a national geodetic framework of monumented control points of known position or elevation.
- producing and maintaining the fundamental mapping of Canada.

The national geodetic framework serves as a basis for all other surveys while the uses of the fundamental map of Canada are extremely varied ranging from tourism to national defence with many intermediate applications. These two functions of the Sector are therefore closely related to the work of many federal departments, the provinces, industry and educational institutions.

In addition, the Surveys and Mapping Branch has a number of specific responsibilities via-a-vis other federal department and industry. They are:

- for the Department of National Defence and Transport Canada, to produce and maintain aeronautical charts and related flight information documents for the regulation and safety of Canadian civil and military aviation,
- for the Department of External Affairs, to maintain the international boundary in an effective state of demarcation as required under international treaty,
- for the Department of Indian and Northern Affairs to execute the legal surveys of Canada lands and to ensure the competence of surveys made under acts and regulations pertinent to the administration and surveying of Canada lands. Eighty percent of these surveys are executed through contracts with land surveyors in private practice,
- to provide the Canadian International Development Agency with professional and technical assistance for surveys and mapping projects sponsored by that agency,
- for the Representation Commissioner, to produce federal electoral maps in accordance with the Representation Commissioner Act and the Electoral Boundary Readjustment Act,
- for the Bilingual District Advisory Board, to produce bilingual district maps in accordance with the Official Languages Act,
- for all federal departments
  - (i) to coordinate aerial photography contracts to industry and ensure adherence to standards for all aerial photography taken for federal department programs, and to provide a national library for all federally owned or controlled aerial and satellite photogrammetry,



- (ii) to provide professional and technical advice including the drafting of specifications, the administration, monitoring, inspection, and approval of contracts with private industry in the various fields of expertise of the branch (surveying, geodesy, photogrammetry, and cartography).

Several senior members of the Branch sit on advisory committees of educational institutions (university and community colleges) involved in teaching surveying, geodesy, photogrammetry and cartography. In addition, each year, the branch organizes a one-week course on surveying and cartography for approximately forty teachers of geography. A few Branch officers give lectures to universities as invited professors.

The relatively recently created Canada Centre for Remote Sensing provides a good example of functional co-ordination with other Federal agencies, provincial organizations, industry and universities in what is called the National Program of Remote Sensing. The Program includes the development of sensing capabilities for multi-mission purposes, the development of analytical and interpretation capabilities for end-users, and the provision of remote sensing data. Involvement is at two levels.

The Inter Agency Committee on Remote Sensing (IACRS) is chaired by EMR and includes, at ADM level, the Federal agencies, DOE, IAND, AGR, FMR, DND, MOT as well as other technical agencies (DOC, NRC). Treasury Board and MOSST are also represented. The Committee acts as a Board of Directors for the centre, reviews policies and provides guidance to ensure that the Centre's policies and major programs effectively serve varied departmental missions and national needs.

At the program and direct activity level, co-ordination is achieved through the Canadian Advisory Committee on Remote Sensing, a body of approximately 250 members from all sectors of Canadian life, organized into 14 on-going working groups.

The Canada Centre for Mineral and Energy Technology (CANMET) formerly the Mines Branch, provides a good example of relation to industry. Its activities are directed toward the production of raw materials by developing new extraction technology; the processing and conversion of minerals, metals and fuels by improving methods for recovery and use; the protection of the environment by preventing or abating pollution arising from mining, metallurgical and energy-producing operations. These are areas of direct concern to the Canadian mineral and fuel producing industry. Interface with industry is achieved by:

- Assistance in forming industry associations, for example the Canadian Carbonization Research Association.
- Assistance to industry by conducting analytical and testing services not otherwise available in Canada.
- Supplying equipment certification services backed by research, for example the Canadian Explosives Atmospheres Laboratory.
- Provision of basic data for the design of industrial equipment, for example Directory of Canadian Coals, Combustion Handbook, etc.
- Resource evaluation in conjunction with the provinces and DREE to encourage industrial development and provide a framework for policy.
- Process development and transfer of technology to industry.
- Information services.

Formal liaison with industry is achieved through the National Advisory Committee on Mining and the National Advisory Committee on Metallurgical Research. Informal contracts are made through scientific meetings, personal visits, etc.

The surveys and research activities of the Geological Survey of Canada provide for the nation basic geological maps and terrain information; ascertain the potential abundance and distribution of Canada's energy and mineral wealth; facilitate exploration, discovery and development of energy and mineral resources; encourage regional development; identify processes

that affect environmental equilibrium and disseminate information on Canada's landmass. The Branch participates in numerous formal arrangements and agreements with Federal and Provincial agencies and provides advice and support in its areas of expertise to industry.

The Earth Physics Branch relates to other government agencies and industry in a similar way by providing information, advice and technical data in its areas of expertise in the earth sciences. The Branch maintains national geophysical networks and data bases. In seismology it provides special services in seismic risk estimation, in engineering seismology and in nuclear explosion detection. In geomagnetism it maintains up-to-date data and maps of the geomagnetic field over Canada for resource exploration, navigation and physical sciences research. In gravity it provides a service for defence and exploration. In geothermal studies the underground thermal regime is defined for resource development and the stability of the earth's crust is determined by geodynamic measurements. Each network is backed up by fundamental research relative to global geophysics, and the evolution of the Canadian landmass.

The Polar Continental Shelf Project (PCSP) was established over 15 years ago primarily to support Arctic research on an interdepartmental basis. Presently 35% of its budget is spent to provide other departments with living accommodations, radio communication and advice based on expert knowledge of the far north. Examples of recent major interdepartmental programs requiring logistic support and co-ordination were the Beaufort Sea Program in 1974/75 and the Eastern Arctic Pipeline Program in 1975.

The Science and Technology Sector supports educational institutions particularly universities, by providing information, data and records in the geosciences and in the fields of minerals, mining and energy. There have been many cooperative projects with graduate research departments of Canadian

universities and there is direct financial support by means of Research Agreements. In 1975-76 EMR provided \$882,670 for Research Agreements, most of which was allocated to Canadian universities. In addition PCSP spends about 7% of its budget in support of university programs on research in the Arctic from Canada, United States and overseas. Very few universities operate in the Arctic without PCSP support.

Personal contacts play a very important role in EMR liaison with Canadian universities. These are frequently achieved through annual meetings of national scientific organizations such as the Canadian Geophysical Union, the Geological Association of Canada, the Canadian Institute of Mining and Metallurgy, etc.

The Department has representation on many of the international scientific unions (International Council of Scientific Unions, International Union of Geological Sciences, International Union of Geodesy and Geophysics, Committee on Space Research, etc.) inter-union commissions, international associations, committees and working groups. A complete list was given in the 1968 Brief which is still largely relevant. The scientific branches of EMR are well represented on the Canadian National Committees for several of the international unions and commissions. The Earth Physics Branch provides geophysical data to world data centres according to international standards and thereby obtains right of access to corresponding data from other countries. The Canada Centre for Remote Sensing is actively involved in scientific and technical exchanges with a large number of countries. Exchanges take place with technologically advanced countries (U.S.A., Europe, Japan), as well as developing countries, for which the Centre assists the Canadian International Development Agency and the International Development Research Centre. In addition the Centre provides active support to pertinent United Nations Organizations, such as the Committee on the Peaceful Uses of Outer Space, the FAO, ESCAP and ECA. The Surveys and Mapping Branch



plays an active role in the affairs of a number of international associations: the International Association of Geodesy, the International Society for Photogrammetry, Federation Internationale des Geometres, International Cartographic Association, Pan American Institute of Geography and History, U.N. Committee on Standardization of Geographic Names and Canada - U.S. Mapping, Charting and Air Photography Planning Committee.

Appendices 1 and 2 provide summary information concerning EMR scientific and technological responsibilities toward other government agencies, industry, the public and international organizations. A complete listing of interdepartmental, interagency and international committees in which the Department plays an active role is lengthy, but can be supplied if needed. Tabulations of federal-provincial areas of formal collaboration and of research agreements are also available, but are not included in this report. Detailed information on these items (except research agreements) was given in the 1968 Brief.

d) Review and revision of operational effectiveness, duties and goals

The program structures for ESSP and MERP outlined in appendices 1 and 2 provide a management tool for review and revision of duties and goals. When these structures have been fully documented they will include summary statements of program outputs, and funding and man-year allocations at the activity, sub-activity and project levels. They will also include demonstrations of program effects in terms of impact on major government thrusts, priorities and long-term social and economic concerns. The review process takes place at Divisional Management, Branch Management and Sector Management levels. Branch Management annually evaluates Branch projects and work elements. New goals are established in the work elements and overall effectiveness of projects and sub-activities are examined.

The calendar of program formulation, implementation and review within the Department is as follows:

1. Action during the current fiscal year affecting on-going activities: this includes analysis of monthly reports by responsibility centres concerning their usage of allocated resources and in the light of evolving issues.
2. Action near the end of the fiscal year: this includes an annual report on outputs of the responsibility centres; appraisal of research scientists, technologists and research managers; report on scientific activities to Statistics Canada (and MOSST) and the Advisory Committee on Northern Development.
3. Action in the fall of the current fiscal year towards definite plans for the following year: main estimates are compiled in the light of Treasury Board direction based on the Program Forecast submitted by the Department in the previous fiscal year.
4. Action in the winter of the current fiscal year leading to the Program Forecast for two years hence: the action consists of 1) setting of priorities as to new major issues, 2) review of past activities as to their relevancy, productivity, and their adequacy for meeting new issues, 3) proposals as to creation, alteration, reorientation or termination of activities.

The annual process of program formulation, implementation and review is handled by a structured hierarchy of management committees at the departmental (policy and executive committees), sectorial, branch, divisional and sectional levels. Between the Minister at the top of the pyramid and the individual scientists and technologists in the laboratories the process involves a good measure of reiteration through the various levels of management. The scientific and technological aspects of activities are measured against other considerations (policies, priorities, and available resources) at the departmental executive committee level.

The Planning and Evaluation Sector, with a major role in corporate planning, fulfills an important advisory and staff function in the above process. Various departmental advisors also have a staff function. The national advisory committees have important impact on policy, economic, scientific and technological concerns.

Other committees with a co-ordinating role have substantial input into the planning of scientific and technological activities. Examples are the Interdepartmental Panel on Energy Research and Development, the Inter-agency Committee on Remote Sensing and the Canadian Advisory Committee on Remote Sensing.

Operational effectiveness is difficult to evaluate objectively. Various branches have implemented special techniques (cost benefit analysis, operational performance measurement systems, etc.) for monitoring progress and assessing effectiveness. The program/activity structures for MERP and ESSP are under development primarily to provide management at all levels with a systematic approach for monitoring and improving work and results in scientific activities.

Nevertheless, the problem remains that scientific activities within the Department must serve many requirements: the needs of government in establishing policy options; formulation of R&D contracts; the needs of mineral and petroleum exploration and other industries, the scientific requirement of making significant new contributions to knowledge. The problem of evaluating effectiveness is therefore different and more complex than in industrial practice. The application of industrial criteria, cost analysis, performance measurement systems, etc. is not always useful or relevant.



e) Outside studies

During the last five years the Geological Survey of Canada has commissioned studies to improve its efficiency in the following areas (1) Branch Registry, (2) Cartography and (3) Library. Other studies involving matters such as Personnel, Finance and Security have been commissioned by the Department or central agencies. However, with the exception of arrangements being made with the Canadian Geoscience Council to form an Earth Science Advisory Committee, no studies have been undertaken on GSC scientific operating procedures.

In the Canada Centre for Mineral and Energy Technology an internal study led to the introduction of a matrix management system throughout the Branch which has had an important impact on its work. With one area of management responsible exclusively for content of the work, interdisciplinary scientific projects have been better directed toward solving problems in the national interest.

At Canada Centre for Remote Sensing cost benefit studies on the role of remote sensing in the development of information and management systems for Canada's resources and environment have been useful in setting long-term goals and objectives. Four such studies were conducted jointly by in-house and outside personnel and have been subjected to review and approval by the Inter Agency Committee on Remote Sensing.

Several outside studies have been commissioned by the Surveys and Mapping Branch which have led to improvements in organization and operations. These are summarized below:

- |  |   |
|--|---|
| 1. Organization study of the Air Photo<br>Reproduction Unit  | Bureau of Management<br>Consulting, DSS, 1970 |
| 2. A solution to the problem of relationships<br>between the departments of EMR, Indian Affairs<br>and Northern Development regarding legal<br>surveys | Bureau of Management<br>Consulting, DSS, 1971 |

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|---|--|
| 3. Report on the National Air Photo Library   | Bureau of Management Consulting, DSS, 1972                         |
| 4. Design and implementation of a cost recovery system for the sale of maps, charts, aerial photographs and special cartographic services | Bureau of Management Consulting, DSS, 1972                         |
| 5. Report on the functions of the Geography Division  | Group of four Canadian geographers, 1975                           |
| 6. An evaluation of the 1:250,000 maps series of the National Topographic System  | Professors A. McGrath and H.W. Castner of Queen's University, 1975 |
| 7. Report of the National Advisory Committee on the National Atlas of Canada  | Dr. J.L. Robinson, U.B.C. with a group of geographers, 1975        |
| 8. Geography Services Directorate - Organizational Alternatives   | Halliwell, Laliberte and Associates Ltd., 1975                     |

g) Major hindrances to effective performance

The 1968 Brief identified several factors which emphasized the difficulties in operating effective science and technology programs within the framework of government bureaucracy. To these we might add:

- 1) Financial and manpower constraints have led to difficulties in most branches and sectors of the Department. In CCRS dedication to the 'buy' policy of industrial participation has led to such a low ratio of in-house personnel to extramural participants that effective interaction with industry and other areas is jeopardized. Lack of manpower and funding have also inhibited R&D at CCRS and participation in joint interdisciplinary projects with user organizations. Dollar and man-year decreases during the 1975/76 fiscal year combined with inflationary increases in operating costs have placed PCSP at a severe disadvantage and led to curtailment in its activities.

Similar problems have beset other branches. To meet increased demands for its products and services the Surveys and Mapping Branch has had to divert staff from its basic activities (e.g. topography) to service areas such as the Canada Map Office and the National Air Photo Library and to the implementation of cost recovery procedures. Over the past ten years there has been a reduction of 68 man years or 16% devoted to the production of the fundamental map of Canada. The Geological Survey has had to divert resources from its geo-science base studies in order to respond to numerous new thrusts and policy initiatives. Continued erosion of these base studies has reduced the Branch's ability to develop the requisite knowledge capital to meet future short-term political demands. The Earth Physics Branch has also found it impossible to maintain its long-term geophysical base studies because of increasing short-term problem solving demands and inadequate financial and manpower resources.

2. The creation of Units Working in French has not improved the efficiency of scientific research and related activities.

- 3) Decentralization priorities may reduce the efficiency of scientific activities.
- 4) Purchasing procedures have become more complex and the service supplied by DSS is thought by some to be less effective than the old Departmental system. This is particularly true of emergency purchases required during field operations, to maintain pilot plants in operation, etc.
- 5) The secretarial service at the scientific level is hindered by low pay, lack of special training for scientific support, and lack of a pay scale that reflects skill and performance. The secretarial requirements for scientific and engineering staff should be recognized as meeting more difficult standards than those encountered in writing business correspondence for senior officers.
- 6) Owing to budgetary procedures there is a great delay between the time when a national requirement is recognized and the time when funding is made available to begin research and investigations. This has hindered the work of the Interdepartmental Task Force on Energy Research and Development.
- 7) Job classification procedures and approvals have become increasingly complex and slow. The identification and fulfillment of language requirements has increased the difficulty of satisfactory recruitment.
- 8) The 1974 prohibition against use of personal service contracts for persons working under the direct guidance of staff has delayed many projects to which it has not been possible to allocate manpower resources. In GSC, for example, this change is reflected in the



total value of contracts let under MERP program that in 1973-75 averaged some \$470,000 per year and more recently (1975-77) will average approximately \$185,000.

- 9) Problems have been encountered in relationships with the Science Procurement group in DSS that have caused delay in letting of contracts in addition to the added costs incurred by using the services of this agency. These problems are related to lack of knowledge and experience of some DSS staff in geochemical and geo-physical contracts and other technical areas.
- 10) A growing problem is the difficulty in responding to unsolicited proposals when resources cannot be found, in a time of budgetary uncertainties, for future continuation of such contracts.

h) Major changes in organization functions

Several organizational and functional changes have occurred within the Department since the 1968 Brief was written. These include:

- October 1, 1968 - The Mineral Resources Division was reorganized as the Mineral Resources Branch.
- April 1, 1970 - Pursuant to the Public Service Rearrangement and Transfer of Duties Act, Order in Council P.C. 1970-562 of March 26, 1970, transferred the control and supervision of the Astronomy Division of the Observatories Branch, the Dominion Astrophysical Observatory and the Dominion Radio Astrophysical Observatory to the National Research Council.
- April 1, 1970 - The Observatories Branch was renamed the Earth Physics Branch.
- September 1, 1970 - The Resource Administration Division was reorganized as the Resource Management and Conservation Branch.
- February 1971 - The Canada Centre for Remote Sensing was established.
- June 11, 1971 - The Government Organization Act 1970, 1970-71, c.42 transferred the responsibility of the Department of Energy, Mines and Resources in matters relating to water research, management and conservation to the Department of the Environment. This resulted in the transfer of the Marine Sciences Branch, (except the sections of Marine Geology and Geophysics), the Inland Waters Branch and the Policy Research and Co-ordination Branch to the Department of the Environment.
- January 1, 1972 - A Senior Assistant Deputy Minister, an Assistant Deputy Minister (Planning and Evaluation), and an Assistant Deputy Minister (Administration), all new positions, were appointed.
- August 1973 - A Senior Economic Adviser, at ADM level, was appointed, on loan from Treasury Board Staff.
- November 1973 - The Office of Energy Conservation was established.
- January 14, 1975 - The name of the Mines Branch was changed to the Canada Centre for Mineral and Energy Technology (CANMET).
  - In addition, the Office of Energy Research and Development is currently being established.

The difficulty in forecasting functional changes in a scientific organization is illustrated by the fact that none of the changes listed above was forecast in 1968. The establishment of an institute on the west coast (1968 Brief, p. 24) is now underway. This is the Patricia Bay Institute of Ocean Sciences. DOE and EMR are both involved with DOE the lead agency. EMR will contribute segments from the Geological Survey of Canada, the Earth Physics Branch and the Canada Centre for Remote Sensing.

R&D activities in EMR will require continual modification as a consequence of technological advances and of changing national needs. For example Canada Centre for Remote Sensing foresees that new technology in the use of microwave transmissions for earth observation purposes will have a major impact because such devices can penetrate fog and cloud and operate with equal effectiveness in day or night. In addition, these devices offer great promise in the study of such phenomena as soil moisture (with obvious applications to agriculture), sea ice thickness and ocean parameters such as wave patterns, sea surface temperature and surface wind speeds (with obvious applications to Maritime and Arctic activities and fundamental scientific applications in the area of large scale weather phenomena). In the next five years CCRS plans to place emphasis on quasi-operational systems, i.e. pilot projects intended to introduce the new remote sensing technology into the operational fields.

There is a growing awareness that materials limit what is technologically possible in a way that makes materials as important a fundamental concern to society as energy and environment. Furthermore, forecasts for continued expansion in Canada's mineral production notwithstanding, there is increasing concern that within the next 50 years, economic supplies of some critical minerals and metals might cease to be sufficient to meet world demands. Among other things, the prospect points to the need for a major, nation-wide study of Canada's needs in materials R&D and a clarifica-

tion of the roles that Federal laboratories, particularly the Physical Metallurgy Research Laboratory, should play in meeting these needs.

Science policy both now and in the future can have a large impact on the development of new energy infrastructures to supplant the decline of the reserves of conventional oil and gas.

Conventional oil refining will gradually change to involve far more hydrocracking to obtain increased liquid yields from low grade crude oils. This change will hopefully be in phase with the development of new in situ techniques for the production of heavy oils and Athabasca bitumen. The development will require substantial advances in reservoir engineering science. The scale of these operations is of such a magnitude that they will have a profound effect upon the funds available for training engineers and scientists. Conversely if science policy is not carefully integrated to meet these needs serious consequences could develop.

The shortages of natural gas will intensify efforts to obtain synthetic natural gas from coal and to transport natural gas from the Arctic. This will involve intensive effort to study material research associated with pipeline and marine transport and coal gasification technology. As all of the coal gasification technology is being developed abroad, it is evident that much greater effort must be made to select the specific technology most suitable for Canadian conditions. This will require increased scientific intelligence work on the part of industry and EMR to clarify the policy options that exist.

The regulatory aspects of the department of Energy, Mines and Resources which involve the approval of explosives manufacturing practices and use of explosives in mines as well as the certification of electrical and diesel equipment for use in mines, can only be maintained at an inter-



nationally competitive level through scientific activity. It is visualized that through research on diesel engines and exhaust gas scrubbing equipment, this type of equipment will become far more widely used when the proper specifications to ensure safety are drafted, based on scientific input developed within the Department.

The establishment of the specifications for the composition of gasoline that will be compatible with the EMR policy to increase efficiency of overall energy utilization including refinery losses and combustion efficiency of the engine with minimum impact on the environment is a problem of such scope that no doubt many different sources of advice will be sought.

Future plans concerning energy supply will probably be more dependent upon the discovery of oil or gas on the Offshore or in the Arctic than on new scientific developments.

There are a number of external pressures and political priorities that may require organizational changes within the branches. The foremost of these concern decentralization and Units Working in French.

SECTION 2.3PERSONNEL POLICIES

The response given on pages 40 to 45 of the 1968 Brief is still relevant and need not be repeated.

The Postdoctoral Fellowship (PDF) Program administered by the National Research Council of Canada was not referred to in 1968. While the main purpose of the program is to provide recent university graduates from Canada and abroad with an opportunity to receive research experience in government laboratories for a period of one to two years, it has also provided the Department with an excellent means of identifying and training promising young scientists. Though it has become increasingly difficult to find suitable full-time positions in today's economic climate, a number of first-class people have been hired in recent years after successfully completing PDF tenure.

With regard to research managers the Department completed a study in 1974 to:

- determine a skills profile that departmental research managers require in order to perform their roles effectively and efficiently.
- design a practical system for identifying potential managers.
- outline the kinds of development experiences that would be desirable for enhancing the quality of management in the Group.

## SECTION 2.4      DISTRIBUTION OF ACTIVITIES

### a) Regional pattern of EMR spending on Scientific Activities

The regional pattern of EMR program expenditures is given in the five following tables:

Table I	Mineral and Energy Resources Program 1973-74
Table II	Earth Science Program 1973-74
Table III	Mineral and Energy Resources Program 1974-75
Table IV	Earth Sciences Program 1974-75
Table V	Total Program Expenditures on Scientific Activities

The following abbreviations are used:

CSC	Geological Survey of Canada
CANMET	Canada Centre for Mineral and Energy Technology
CCRS	Canada Centre for Remote Sensing
EPB	Earth Physics Branch
S & M	Surveys and Mapping Branch
PCSP	Polar Continental Shelf Project

These tables indicate the funding allocated to the scientific branches of EMR based in Ottawa and to their regional offices, institutions and stations distributed in various parts of Canada. While the figures given here represent the only breakdown of regional spending readily available, they do not provide the complete picture. Much funding for ground and airborne surveys, for grants, contracts and research agreements which has been attributed to headquarters in Ottawa has actually been spent in other areas. For example PCSP spends over 40% of its budget in provinces other than Ontario; CCRS contracts out much of its work and the survey operations of all branches are national in scope. Probably less than 70% of the budget for the two departmental programs is spent in Ottawa notwithstanding the figures given in Table V.

Table I Mineral and Energy Resources Program  
1973-74

Province and Location	Unit	Expenditures (\$000)		
		Current	Capital	Total
Nova Scotia				
Dartmouth	G.S.C. Atlantic Geoscience Centre	1,575	270	1,845
Glace Bay	CANMET	160	-	160
		1,735	270	2,005
Quebec				
Quebec City	CANMET	96	5	101
Ontario				
Ottawa	G.S.C.	7,771	497	8,268
	CANMET	11,208	488	11,696
	Energy Development Sector	302	-	302
Elliot Lake	CANMET	445	25	480
		19,736	1,010	20,746
Alberta				
Calgary	G.S.C. Inst. of Sedimentary & Petroleum Geology	2,671	1,129	3,800
	CANMET	340	11	351
Edmonton	CANMET	182	100	282
		3,193	1,240	4,433
British Columbia				
Vancouver	G.S.C. Regional Office	729	39	768
	TOTALS	25,489	2,564	28,053



Table II

Earth Science Program  
1973-74

Province and Location	Unit	Expenditures (\$000)		
		Current	Capital	Total
Quebec dispersed	EPB - Geophysical Observatories	15	-	15
Ontario Ottawa	EPB	3,707	262	3,969
	CCRS	3,676	2,080	5,756
	PCSP	2,716	87	2,803
	GSC	1,648	44	1,692
	S & M	13,635	864	14,499
		25,382	3,337	28,719
Manitoba dispersed	EPB - Geophysical Observatories	15	-	15
Saskatchewan Prince Albert	CCRS - Satellite Receiving	-	75	75
Alberta Calgary	G.S.C. Terrain Sciences	549	-	549
dispersed	EPB - Geophysical Observatories	85	-	85
		634	-	634
British Columbia Victoria	EPB Victoria Geophysical Observatory	150	10	160
dispersed	EPB - Geophysical Observatories	40	-	40
		190	10	200
N.W.T. dispersed	EPB - Geophysical Observatories	240	200	400
	TOTALS	26,456	3,622	30,098

Table III

Mineral and Energy Resources Program  
1974-75

Province and Location	Unit	Expenditures (\$000)		
		Current	Capital	Total
Nova Scotia				
Dartmouth	G.S.C. Atlantic Geoscience Centre	2,047	220	2,267
	CANMET	23	-	23
Halifax	CANMET	10	-	10
		2,080	220	2,300
Quebec				
Quebec City	CANMET	43	-	43
Ontario				
Ottawa	CANMET	12,215	588	12,803
	G.S.C.	8,885	527	9,412
	Energy Development Sector	312	-	312
Elliot Lake	CANMET	389	19	408
		21,801	1,134	22,935
Alberta				
Calgary	G.S.C. Institute of Sedimentary & Petroleum Geology	3,240	150	3,390
	CANMET	185	10	195
Edmonton	CANMET	108	6	114
		3,533	166	3,699
British Columbia				
Vancouver	G.S.C. Regional Office	950	36	986
	CANMET	36	-	36
		986	36	1,022
	TOTALS	28,443	1,556	29,999

Table IV

Earth Science Program  
1974-75

Province and Location	Unit	Expenditures (\$000)		
		Current	Capital	Total
Quebec				
dispersed	EPB - Geophysical Observatories	50	-	50
Ontario				
Ottawa	EPB	4,068	295	4,363
	CCRS	2,337	2,080	4,417
	PCSP	2,764	235	2,999
	GSC	2,453	63	2,516
	S & M	15,264	984	16,248
		26,886	3,657	30,543
Manitoba				
dispersed	EPB - Geophysical Observatories	20	-	20
Saskatchewan				
Prince Albert	CCRS Satellite Receiving Station	25	75	100
Alberta				
Calgary	GSC Inst. of Sedimentary & Petroleum Geology	66	-	66
dispersed	EPB - Geophysical Observatories	130	2	132
		196	2	198
British Columbia				
Victoria	EPB Victoria Geophysical Observatory	175	15	190
dispersed	EPB - Geophysical Observatories	60	-	60
Vancouver	GSC Regional Office	141	-	141
		376	15	391

Table IV (con't)

Earth Science Program  
1974-75

Province and Location	Unit	Expenditures (\$000)		
		Current	Capital	Total
N.W.T. dispersed	EPB Geophysical Observatories	355	30	385
	TOTALS	27,908	3,779	31,687





- b) Regions particularly suited for scientific activities
- c) Activities related to regional problems or phenomena
- d) The role of EMR in contributing to regional development
- e) Costs and benefits of regional distribution of scientific activities

The remarks in the 1968 Brief (pp 97-101) are still generally relevant except that the Department has acquired the Canada Centre for Remote Sensing since that time but no longer has responsibilities for inland waters and astronomy.

#### 1. Geological Survey of Canada

By its nature geoscience must be primarily carried out "on the ground", and with its national mandate the Branch carries out its scientific activities in all regions of Canada including off-shore regions.

With regard to the location of scientific establishments the Geological Survey has a number of regional offices that are located in centers that provide good communications, that are in the regions of particular concern to the specialized geologists working from the office, and that allow inter-communication of information and advice with concerned government, industry and university staffs. As examples, marine geology on the East Coast is carried out from Dartmouth, Nova Scotia; Cordilleran geology from Vancouver, B.C., and petroleum geology from Calgary, Alberta. In Ottawa are centered a number of units that have Canada-wide responsibilities and others providing services to all Branch units.

For GSC a comprehensive listing of regional activities would include the majority of the approximately 500 projects currently in progress. A few examples are:

- 1) A project, in conjunction with Earth Physics Branch to recognize, identify and evaluate geothermal potential in Canada. Initially attention has been focussed on resources of volcanic origin in British Columbia and Yukon and on hot water reservoirs in the Great Plains and northern regions of Canada.

- 2) Investigation and evaluation of the geological setting, petrological character, origin and economic potential of the major plutonic complexes of Anorthositic and related rocks in Labrador and Quebec. These complexes are important because concentrations of iron-titanium ores, copper-nickel mineralization and alumina are often associated with them.
- 3) In terrain sciences studies related to "landslides" or slope stability have been carried out in the Mackenzie Valley Transportation Corridor, along the major transportation routes of Southern British Columbia and in the Ottawa-St. Lawrence lowlands of Ontario and Quebec. The objectives of these investigations have been determined by hazards inherent in land use activities as they relate to the geological environment of those areas.

The geoscience activities of GSC contribute to regional development by indicating areas suitable for mine development, areas favourable to oil and gas exploration, and areas suitable for consideration as transportation corridors or as building sites for dams and other structures. Many specific examples could be given.

The costs, other than financial, of decentralization of scientific activities include factors such as lack of intercommunications between staff in different disciplines of geology, slower response to urgent requests from headquarters, duplication of same library and laboratory facilities, and increased difficulty in developing close linkages with other federal agencies in Ottawa. The benefits include improved access to field areas, providing a federal response outside Ottawa and improved service to concerned customers (provincial agencies, industry, public). A necessary condition of decentralization is that units be located in areas that are recognized as centres of industry, mining, petroleum or offshore geoscience expertise. In some cases the presence of units of the Geological Survey has helped to foster further development of industry such as the marine technology industry in Halifax and geophysical exploration companies in the vicinity of Ottawa.

## 2. Canada Centre for Mineral and Energy Technology

As in 1968 elements of the Mining Research and Energy laboratories are located in Elliot Lake, Ontario, Point Edwards, Nova Scotia, and Edmonton, Alberta. In July 1971 a regional laboratory of the Mining Research Laboratories was opened in Calgary, Alberta.

During the last four years CANMET has contracted out research to the value of \$1,000,000/year. The work has been distributed to research establishments across the country.

As pointed out in the 1968 Brief, since most of the work of EMR has a general effect on regional development, it is difficult to be precise about the effort that is specifically initiated because of the need for development of one particular region or another. CANMET's work has, as a first priority, the technology and information base needed to ensure the long-term supply of minerals and mineral products based on the perceived national needs. For example, improvement of the working environment in underground mines is essential if we are to meet our forecast requirement for uranium. Successful solutions to this problem will ensure the continued development of existing uranium-producing areas and the development of new ones. Another example is work by CANMET to improve the recovery of metal from our complex zinc/lead/copper ores (to increase our supply of these metals) which will lead to increased development in the Maritimes.

CANMET's research on western Canada coking coal which led to the development of major markets for coal in Japan will be strengthened by improving the research facilities at Clover Bar near Edmonton. Improvements will also be made to the coal cleaning facilities as well as the coke ovens. This should provide more immediate coking coal evaluation service in Western Canada.



CANMET staff and activities have a continuing input into regional programs through DREE, and federal-provincial co-operative activities. CANMET has contributed recently to the planning and subsequent monitoring of mineral processing activities under a N.B.-federal DREE program, and work concerned with mineral development in the three western provinces (WEOC). The Nova Scotia coal exploration is funded partly by DREE and partly by the N.S. Government. It seems likely that the New Brunswick coal exploration program will be operated along similar lines.

There are important benefits to having regional laboratories. The resolution of problems of mining, tailings management and mine working environment requires that the work be done under actual conditions in the field. The laboratories at Elliot Lake and Calgary are more conveniently located for conducting work "on location" than if the staff were located in Ottawa. From the point of view of evaluating commercial coals, assessing variations in the composition of coal seams, and providing a base for field operations, regional centres are of very considerable benefit. It is much less expensive to operate these programs regionally than from Ottawa.

### 3. Canada Centre for Remote Sensing

CCRS satellite receiving stations exist at Prince Albert, Saskatchewan and Shoe Cove, Nfld. The costs are as follows:

Prince Albert Satellite Station	\$ 930,000
Shoe Cove Satellite Station	\$ 280,000
Canada Centre for Remote Sensing (Ottawa, Ontario)	\$4,031,000

A satellite station should be located in such a way that it covers the terrain of interest. Since the radius of coverage of a station is about 2,000 miles, there would be a need for approximately 4 stations to provide

complete coverage of regions of importance to Canada. The present station at Prince Albert is centrally located and the new Shoe Cove station will cover the East Coast off-shore waters and the Eastern Arctic. Future stations might be located on the West Coast and the High Arctic to serve interests in these regions.

All of the Centre's activities are, in the last analysis, directed to the investigation of broad-scale surface phenomena in the various regions of Canada. Each year, the Centre develops a number of instruments, vehicles, methods and systems to provide resource and environmental data to provincial managers, federal government research organizations, universities and private industry. Output from such devices includes repetitive coverage of the whole of Canada in the case of satellite systems in order to study dynamic phenomena such as crops, forestry, hydrology, etc. In addition, approximately 150 airborne projects are requested every year by Canadian users to study problems specific to their provinces or regions.

The Canada Centre for Remote Sensing also contributes to regional development through direct investment and invitation of local participation in the operation of the Centre's two satellite stations in Prince Albert, (Sask.) and Shoe Cove (Nfld.), as well as the operation of its fleet of 4 aircraft from appropriately located industrial facilities across the country.

A decentralization of aircraft ground facilities reduces transit time for repair and maintenance and facilitates mission planning. As long as common sense is used in selecting the proper facilities for decentralization, the costs involved are minimal. However, attempting to relocate certain headquarter units would result in prohibitive costs and could cripple operations for lack of adequate support facilities.

#### 4. Polar Continental Shelf Project

The Polar Continental Shelf Project was established specifically to co-ordinate effective logistics for government research in the Arctic environment and to promote a better understanding of this unique region.

Meteorology and climatology of the Arctic are important because of their influence on the weather of southern regions. The study of growth, decay, and movement of sea ice in arctic coastal waters provides vital information regarding the feasibility of using ships as a means of transport for natural resources and supplies. The use of sea ice as a platform provides a unique opportunity of conducting experiments in geophysics and marine sciences over an ocean environment.

A few examples of activities undertaken by various government departments over the last five years in which PCSP has participated through co-ordination and supply of logistics are:

- 1) The systematic survey of land and waters of the Arctic Archipelago and adjacent ocean waters to determine the regional force of gravity for prospecting and geodetic purposes.
- 2) The bathymetric survey of all navigable waters within the Arctic Archipelago by measurements over the ice and from shipborne platforms.
- 3) The study of all species of wildlife in the Canadian Arctic including animal community studies, aquatic ecosystems, harassment problems, habitats, etc.
- 4) Geoscientific studies directed toward natural phenomena and the development and husbanding of irreplaceable natural resources.

These activities have all contributed toward regional development. A geoscience data base is required so that a logical development of natural resources may be regulated and maintained by the Federal Government in Arctic regions.

## 5. Earth Physics Branch

In view of the geographical location, size, and composition of its landmass, Canada is particularly suited for geophysical research. For example, we play host to the North Magnetic Pole and, along with Alaska, form the only major landmass in the world on which the auroral zone and its related phenomena are accessible for observation and study. Off western Canada we have an active spreading ridge close to Vancouver Island which provides an opportunity for the study of plate tectonics and its implications. Canada also contains the quietest seismic terrain in the world for recording distant earthquakes and man-made explosions. These and many other examples illustrate why national networks of geophysical observatories are important for Canada and why observations are required in all regions. The geological and tectonic provinces of Canada form vast areas which must be understood in terms of their structure, physical and chemical properties, mineral and economic potential, history and evolution. There is no region of Canada (including the off-shore regions) which is unimportant in this context and which would not be included within the framework of a national program.

The scientific activities of the Earth Physics Branch provide geophysical data and information over the whole of Canada, much of which is valuable to the resource and exploration industries. The national program for estimating seismic risks contributes information relevant to building codes, pipeline and dam construction in regions as varied as Vancouver, Quebec City, Northern Quebec and Mackenzie Delta. Gravity maps are available over most of the country as are high-level aeromagnetic data. Geothermal resources in Cordillera regions are under evaluation and regions which are undergoing vertical movement and deformation (for example Hudson's Bay and the surrounding lowland) are under intensive study. Geomagnetic disturbances vary enormously in character and intensity between southern regions, the auroral zone, and polar regions. They have



important effects on short-wave radio communications and can create hazards in transmission power lines. Paleomagnetic studies provide information on the history and evolution of the various tectonic provinces which form the Canadian landmass. The evolutionary process is important in understanding how fossil fuel and economic mineral deposits were originally formed and where they might be located.

The Earth Physics Branch contributes in different ways to regional development. This can vary from improved safety codes for building in all cities of Canada to basic geophysical maps leading to mineral exploration and possible development within a region. The Branch provides fundamental information for the safe siting of nuclear reactors, a description of the permafrost regime for energy transportation corridors in northern regions, and has prime responsibility for assessment of geothermal resources in Canada.

Without geophysical observations in every region, a national program for Canada would not be possible. A major sub-division of the Branch is located in Victoria to provide services to Western Canada in an active seismic region. However, total decentralization of Branch headquarters is a different matter and would lead to greatly increased costs and reduced efficiency through separation from central support services and from the other branches.

#### 6. Surveys and Mapping Branch

Mapping and survey activities are carried out equally according to needs in all areas of the country. However, because the need is greater in the meridional areas, most of the southern part of Canada is covered by maps at the scale of 1 in 50,000, whereas only pockets of the north are mapped at that scale. Similarly, the density of geodetic control points is greater in the South than it is in the North.

Legal Surveys, a division of the Branch, operates regional offices

in nine Canadian centres with the following staff:

Amherst	6	Edmonton	6
Quebec City	6	Vancouver	11
Toronto	13	Whitehorse	2
Winnipeg	5	Yellowknife	2
Regina	4		

These offices are in close contact with local representatives of the Department of Indian and Northern Affairs, thus providing better and quicker service in response to the surveys and mapping needs of the client department.

A number of activities are carried out to assist in the investigation of regional problems of phenomena. One example is the annual program of re-levelling carried out every year to measure the subsidence caused by some large Canadian dams. Thus it was established that the area around Bennett Lake sunk 9 cm between 1964 and 1969 and has been stable since. Tide gauges are regularly monitored to measure ephemeral and cyclical changes of the tides, and the re-levelling program of Geodetic Survey provides useful information on crustal tilts.

In a different field, the annual program of aerial photography of the Surveys and Mapping Branch is often useful to monitor agricultural production, forest fire and flood damages, glacier movements and other such phenomena.

Accurate and dependable maps are almost always required prior to any major development. They are or should be the first step in any orderly environmental base study and should be requested well ahead of any regional development. While the cost of maps seldom amounts to more than a very small fraction of that of most development projects, failure to obtain them on time can be very costly indeed.

Axiomatic to the mapping process is the need for a fundamental geodetic framework. Such a framework makes it possible to accurately relate all map details to each other. Once established and properly maintained, it will serve for many years towards the orderly development of the region by allowing the integration of all detailed surveys into the national network.

It is almost impossible to evaluate the impact of surveys and mapping on regional development. Perhaps the best way to illustrate the contribution of the Branch is to give a couple of examples:

- (1) The Mackenzie River project required the preparation in 1972 of 350 new map sheets at the scale of 1 in 50,000. These maps were used by the Department of the Environment and the Department of Indian and Northern Affairs for environmental studies, by the Department of Public Works for road construction and pipeline route studies and by the Geological Survey of Canada.
- (2) James Bay Project. Accurate maps are essential for the planning of any hydro-electric power development. The James Bay project required the preparation of nearly 200 new topographical maps at 1:50,000 scale.

SECTION 2.7      RESEARCH POLICIESPart (a)    Units concerned with intramural research activities1,2.    Selection, initiation and monitoring of programs and projects

The commentary given on pages 16-19 of the 1968 Brief still applies.

The program structures for MERP and ESSP are described in Section 2.2 and in Appendices 1 and 2. They have been developed to provide management with a systematic means of monitoring program outputs and results relative to resource input and their effectiveness relative to the Department's mission. The program structure is also designed to be flexible and to provide in an organized fashion the information needed to adjust priorities between projects; to re-allocate funds and personnel; and to initiate new projects or terminate existing ones. In this way the Department hopes to respond effectively to changing needs and requirements within the limitations of manpower and funding which are imposed upon it.

An outline is given under section 2.2(d) of the departmental calendar of program formulation, implementation and review.

Criteria used in various areas of the Department for determining priorities are relevance to the issues of the day, effectiveness as to long-range programs, cost/effectiveness analysis, total cost of a project in relation to total budget, probability of success, availability of necessary expertise either in-house or externally, and possibility of conflict with projects of other government or private agencies.

National and international scientific projects which lie within the area of the Department's mission and expertise, or which relate in a special way to the Canadian landmass and its natural resources, often create an obligation for support and active participation. These can therefore



influence project selection and initiation and to some extent priorities. Examples of national or international projects in which the Department has played or will play an active role are the Beaufort Sea Program, the AIDJEX study, the Eastern Arctic Pipeline Program, the Social Economic Development Program, and the forthcoming International Magnetosphere Study.

### 3. Network methods

Network methods such as CPN or PERT are not widely used throughout the Department and are not considered appropriate for bench-scale research. They are more useful in undertaking development work on a large scale. In CANMET work is organized and co-ordinated through a number of projects each containing a number of elements. It is often important for one element to be well advanced or completed before another can be properly conceived. This requires a degree of critical path planning. In the Earth Physics Branch, Critical Path Network analysis has been used to monitor certain instrument developments; for example the Eastern Canadian Telemetered Network involving remote digital seismic observatories, the digital transmission of seismic signals, and a dedicated computer system to interpret the on-line data. In CCRS network methods are routinely used to monitor projects whose complexity warrant their use.

### 4. Contracting out projects in support of intramural programs

### 5. Funding of extramural research programs in the universities and industry

#### Intramural & Extramural Funding

A number of tables have been compiled on EMR expenditures on scientific activities, their distribution intramurally and extramurally, and their disposition on R&D contracts, R&D grants, fields of principal application, etc. These tables would provide a partial answer to Question 2.6; they are presented here to illustrate what has been done within the Department over the last few years by way of contracting out projects and the extent to which we have been funding extramural research in universities and industry.

The tables give EMR expenditures on scientific activities for the fiscal years 1973-74, 1974-75, 1975-76 (estimates) and 1976-77 (projected). Data were obtained from Financial Services, EMR, MOSST - EDP Systems, 29 Sept. 1975, and the Science Procurement Division, DSS.

The terminology used in these tables corresponds to the definitions used by Statistics Canada and MOSST in which scientific activities are categorized as follows:

1) <u>R&amp;D</u>	2) <u>Related Scientific Activities</u>
In-house R&D	Scientific data collection
R&D contracts	Scientific information
R&D grants	Testing and standardization
Research fellowships	Feasibility studies
	Education support
	Capital
	Admin. of extramural R&D
	Admin. of extramural RSA

In connection with the nine tables which follow several points may be noted:

- Nearly all of the extramural funding is distributed between R&D and scientific data collection. The major portion goes to scientific data collection (about 44%) followed by R&D contracts (about 35%) and R&D grants (about 18%). Some change in extramural funding since 1973-74 is seen between contract and grant funding.
- Funding of extramural R&D and extramural scientific data collection are approximately constant, as a percentage of corresponding total funds, over the period 1973-77.
- Of extramural R&D funding, the major portion (~60%) goes to Canadian industry, followed by universities (~16%). Funds for data collection go essentially to Canadian industry (over 90%).
- There is a steady increase in the percentage of R&D contract funds going to Canadian industry (40% in 1973-74 to 83% in 1976-77). This has been accompanied by a decline in percentage R&D contract funds to universities.

- During 1974-77 the major portion of R&D grant funding is to universities (~60%). A substantial percentage increase in grants to provincial and municipal governments is shown over the period.

TABLE I

Expenditures on Scientific Activities  
(\$000)

	EXPENDITURES			
	<u>TOTAL</u>	<u>Intramural</u>	<u>Extramural</u>	<u>% Extramural</u>
<u>1973-74</u>				
MERP				
Human Sciences	1,719	1,581	138	8.0
Natural Sciences	33,436	28,239	5,197	15.5
ESSP	31,984	29,913	2,071	6.3
	<u>67,139</u>	<u>59,733</u>	<u>7,406</u>	<u>11.0</u>
<u>1974-75</u>				
MERP				
Human Sciences	2,024	1,817	207	10.2
Natural Sciences	33,464	30,057	3,407	10.2
ESSP	35,774	31,717	4,057	11.0
	<u>71,262</u>	<u>63,591</u>	<u>7,671</u>	<u>10.8</u>
<u>1975-76 (EST)</u>				
MERP				
Human Sciences	2,116	1,935	181	8.6
Natural Sciences	38,130	34,048	4,082	10.7
ESSP	38,690	34,227	4,413	11.4
	<u>78,936</u>	<u>70,260</u>	<u>8,676</u>	<u>11.0</u>
<u>1976-77 (PROJ)</u>				
MERP				
Human Sciences	3,080	2,786	294	9.6
Natural Sciences	43,171	39,175	3,996	9.3
ESSP	47,005	41,408	5,597	11.9
	<u>93,256</u>	<u>83,369</u>	<u>9,887</u>	<u>10.6</u>



TABLE II

Expenditures on Research and Development  
(\$000)

	EXPENDITURES			
	<u>TOTAL</u>	<u>Intramural</u>	<u>Extramural</u>	<u>% Extramural</u>
<u>1973-74</u>				
MERP				
Human Sciences	1,292	1,154	138	10.7
Natural Sciences	21,557	18,086	3,471	16.1
ESSP	7,971	7,368	603	7.6
	<u>30,820</u>	<u>26,608</u>	<u>4,212</u>	<u>13.7</u>
<u>1974-75</u>				
MERP				
Human Sciences	1,567	1,360	207	13.2
Natural Sciences	21,436	19,438	1,998	9.3
ESSP	8,652	6,648	2,004	23.2
	<u>31,655</u>	<u>27,446</u>	<u>4,209</u>	<u>13.3</u>
<u>1975-76 (EST)</u>				
MERP				
Human Sciences	1,633	1,452	181	11.1
Natural Sciences	24,021	21,913	2,108	8.8
ESSP	9,201	7,093	2,108	22.9
	<u>34,855</u>	<u>30,458</u>	<u>4,397</u>	<u>12.6</u>
<u>1976-77 (PROJ)</u>				
MERP				
Human Sciences	2,063	1,769	294	14.2
Natural Sciences	27,415	25,551	1,864	6.8
ESSP	11,897	8,516	3,381	28.4
	<u>41,375</u>	<u>35,836</u>	<u>5,539</u>	<u>13.4</u>

TABLE III  
Expenditures on Scientific Data Collection  
 (\$000)

		EXPENDITURES		
	<u>TOTAL</u>	<u>Intramural</u>	<u>Extramural</u>	<u>% Extramural</u>
<u>1973-74 *</u>				
MERP				
Human Sciences	244	244	---	0.0
Natural Sciences	6,112	4,260	1,852	30.3
ESSP	13,026	11,533	1,493	11.5
	<u>19,382</u>	<u>16,037</u>	<u>3,345</u>	<u>17.3</u>
<u>1974-75</u>				
MERP				
Human Sciences	330	330	---	0.0
Natural Sciences	6,247	4,843	1,404	22.5
ESSP	15,491	13,506	1,985	12.8
	<u>22,068</u>	<u>18,679</u>	<u>3,389</u>	<u>15.4</u>
<u>1975-76 (EST)</u>				
MERP				
Human Sciences	347	347	---	0.0
Natural Sciences	7,314	5,370	1,944	26.6
ESSP	16,415	14,205	2,210	13.5
	<u>24,076</u>	<u>19,922</u>	<u>4,154</u>	<u>17.2</u>
<u>1976-77 (PROJ)</u>				
MERP				
Human Sciences	369	369	---	0.0
Natural Sciences	8,956	6,824	2,132	23.8
ESSP	19,612	17,491	2,121	10.8
	<u>28,937</u>	<u>24,684</u>	<u>4,253</u>	<u>14.7</u>

\* Data for 1973-74 are approximate

TABLE IV

Disposition of Extramural R&D Expenditures  
(\$000)

R&D Contracts

	<u>1973-74</u>	<u>1974-75</u>	<u>1975-76</u>	<u>1976-77</u>
Can. Industry	580 (40)	1,369 (47)	1,676 (61)	3,232 (83)
Can. Universities	477 (33)	475 (16)	378 (14)	355 ( 9)
Other Canadian	261 (18)	941 (33)	641 (23)	306*( 8)
Foreign	132 ( 9)	105 ( 4)	51 ( 2)	
	<u>1,450</u>	<u>2,890</u>	<u>2,746</u>	<u>3,893</u>
% of extramural R&D	34.8	68.7	62.4	70.3
% of total R&D	4.7	9.1	7.9	9.4

R&D Grants

Can. Industry	6 ( 4)	-	-	-
Can. Universities	805 (30)	867 (66)	975 (59)	980 (60)
Can. Non-Profit	1,826 (66)	336 (25)	345 (21)	
Prov. & Municipal	9 (<1)	40 ( 3)	235 (14)	
Other Canadian	54 ( 2)	64 ( 5)	84 ( 5)	666*(40)
Foreign	11 (<1)	12 ( 1 )	12 (<1)	
	<u>2,711</u>	<u>1,319</u>	<u>1,651</u>	<u>1,646</u>
% of extramural R&D	65.2	31.3	37.6	29.7
% of total R&D	8.8	4.2	4.7	4.0

Figures in brackets are percentages of the totals shown

\* Includes all other

TABLE V

Disposition of Extramural Expenditures  
on Scientific Data Collection  
(\$000)

	<u>1973-74</u>	<u>1974-75</u>	<u>1975-76</u>	<u>1976-77</u>
Can. Industry	2,644 (81)	3,184 (94)	3,954 (95)	4,032 (94)
Can. Universities	56 ( 2)	45 ( 1)	64 ( 1)	80 ( 2)
Can. Non-Profit	5 (<1)	5 (<1)	5 (<1)	
Prov. & Municipal	315 ( 9)	---	---	
Other Canadian	197 ( 6)	103 ( 3)	108 ( 3)	141 ( 4)
Foreign	38 ( 1)	52 ( 1)	23 (<1)	
	<u>3,255</u>	<u>3,389</u>	<u>4,154</u>	<u>4,253</u>
% of total scientific data collection	16.8	15.4	17.2	14.7

TABLE VI

Principal Application of Extramural R&D Funding (\$000)

	<u>1973-74</u>	<u>1974-75</u>	<u>1975-76</u>
Energy and Fuels	2,310 (58)	868 (22)	1,006 (23)
Mineral Resources	1,126 (28)	1,323 (33)	1,148 (27)
Terrain Assess; Remote Sensing; Satellite and Airborne; National Geodetic and Mapping; Etc.		1,733 (43)	1,887 (45)
Other	552*(14)	78 ( 2)	181 ( 5)
	<u>3,958</u>	<u>4,002</u>	<u>4,222</u>

\* NOT BROKEN DOWN: PROBABLY MOST IN TERRAIN ASSESS., ETC.



TABLE VII

Intramural R&D Activities

	<u>1973-74</u>	<u>1974-75</u>	<u>1975-76</u>
	<u>%</u>	<u>%</u>	<u>%</u>
Free Basic Research	1	10	1
Oriented Basic Research	14	6	15
Applied Research	66	63	63
Experimental Development	20	21	22

(PERCENTAGES BASED ON EXPENDITURES)

TABLE VIII

Total Extramural Expenditures on Scientific Activities by Fields (\$000)

<u>FIELD</u>	<u>1973-74</u>	<u>1974-75</u>	<u>1975-76</u>	<u>1976-77</u>
Can. Industry	3,232 (44)	4,613 (60)	5,270 (66)	7,354 (74)
Can. Universities	1,273 (17)	1,387 (18)	1,417 (16)	1,415 (14)
Can. Non-Profit	1,883 (25)	354 ( 5)	385 ( 4)	
Prov. & Municipal	324 ( 4)	40 ( 1)	235 ( 3)	
Other Canadian	512 ( 7)	1,108 (14)	833 (10)	1,118 (12)
Foreign	182 ( 3)	169 ( 2)	86 ( 1)	
	<u>7,406</u>	<u>7,671</u>	<u>8,676</u>	<u>9,887</u>

TABLE IX

Contracts Awarded through DSS on behalf of EMR  
(Science Procurement Division of DSS)

1973-74	102 contracts:	\$2,747,730
1974-75	143 contracts:	\$5,338,290
1975-76 (to Aug. 31)	72 contracts:	\$5,239,845
	TOTAL TO DATE:	<u>\$13,325,865</u>

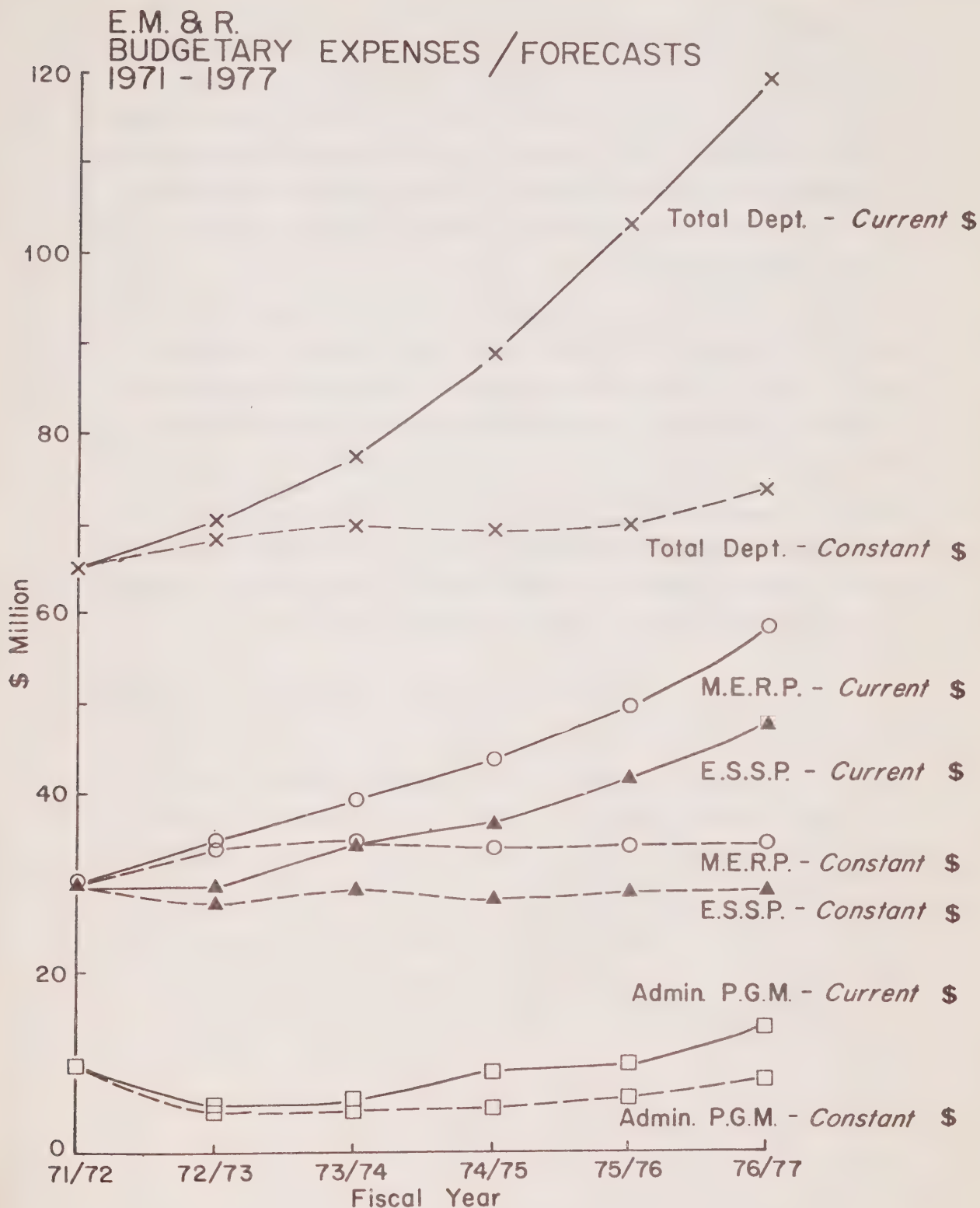
Contracts awarded through DSS on behalf of EMR rank second,  
in total funds, of all federal departments.

### Extramural Research Programs in Universities and Industry

Funding of research programs in universities and industry is largely through R&D grants and these are, for the most part, awarded through the Research Agreement Program of the Department. The pattern of EMR spending on R&D grants is given in the foregoing tables.

Contracts awarded through Unsolicited Proposals are another means of funding research programs in universities and industry. Unsolicited Proposals funded by EMR from Jan. 1, 1974 to Oct. 15, 1975 are listed in Appendix 4. Contracts let on behalf of EMR are listed each month in the R&D Bulletin published by DSS.

The Department of Energy Mines and Resources has supported the Make or Buy policy since its inception in 1972. This has been particularly true of new programs and projects for which in-house capability and hardware were not on hand. The Canada Centre for Remote Sensing (established in 1971) is a good example. CCRS has already commented in this report (Section 2.2 g) that its ratio of in-house personnel to external participants is too low for effective interaction with industry. Its flying activities have recently been transferred from the Armed Services to industry. The relatively new Energy Sector has been instrumental in arranging substantial grants and loans for electrical R&D, and maintains the minimum technical expertise required for advice and policy determination. Long established branches have the problem that the major portions of their operating funds are required for salaries. Thus while the Department as a whole is spending about 13% of its R&D budget and 16% of its RSA budget extramurally, these percentages would be much higher





(40% or more) if the effect of salaries were removed. Another major problem in contracting out is that departmental expenditures on scientific activities, in terms of constant dollars, have remained essentially unchanged since 1971. This is shown on the accompanying figure in which scientific expenditures are divided between the MERP and ESSP programs. This provides some rationale for the fact that extramural expenditures (as a percentage of total expenditures) show no increasing trend since 1973 in Tables I, II and III.

Make and Buy guidelines were formulated with the objective of directing extramurally as far as possible new programs and new expenditures. It was not an objective to dispense with the in-house expertise of scientists and laboratories, or to effect major social disturbance by massive firing of dedicated personnel. Growth in scientific activities since World War II led to the hope that further growth would permit Government to direct substantial R&D activities extramurally, especially new programs. Economic, financial, and budgetary restraints have been such that growth in R&D has been below original expectations and therefore less work has been contracted out than had been hoped for.

The nature of industrial activities in Canada has had its impact on the distribution of scientific activities. Canada's R&D expenditures, as a percentage of G.N.P., has been lowest among major industrialized countries and Canadian industrial R&D funding and performance relative to Government has been lowest. As a result of substantial importation of needed foreign capital, Canada now faces the problem of branch plants using R&D carried on by parent companies located outside Canada. This has handicapped the development of R&D industrial capability in Canada, restricted the number of firms with extensive research capabilities, and reduced the amount of work Government could direct extramurally. The

Federal Government has had to fill the breach by meeting national needs from its own scientific activities supported by pooled public funds (taxes). Canadian industry makes use of the resulting facilities created in EMR for example, as no outside interests have been willing to develop such capabilities. R&D carried out by parent companies outside Canada has the double effect within Canada of lowering the proportion of R&D relative to G.N.P., and the proportion of R&D funded by industry relative to Government. This has the further effect of lessening industrial R&D capability to which Government could turn. A not inconsiderable portion of the half billion dollars the Canadian Government contributes annually to provincial education goes to universities for training researchers and towards the salaries of professors carrying out research, -- a fact commonly ignored in assessing the contribution by the Canadian Government to the general welfare of R&D in Canada.

Resource development plays a relatively greater role in the economy of Canada than for most industrialized countries. Canada's industrial development is based on the domestic availability of natural resources. Within the Federal Government's policy of promoting greater economic health through greater industrialization, the further processing of resources before export in order to derive greater benefit from their exploitation is a priority.

EMR and departments that preceded it have long engaged in geo-scientific activities in order to promote resource development, ensure resource availability for domestic industrial needs, extract maximum benefit from surplus to be exported, provide sound national resource management, and contribute to regional economic development. Such activities are common to all industrialized countries.

The 1971 study by the Science Council of Canada on the Status of the Earth Sciences determined that 87% of Canadian expenditures on

overall geoscientific activities was made by industry and less than 8% by the Federal Government; furthermore, over 63% of Canadian expenditures on geoscientific R&D was made by industry and slightly over 20% by the Federal Government including grants and contracts given externally. On this basis EMR is a commendable exception to the situation previously referred to.

Part of intramural geoscientific activities involve the marrying of data produced in-house with data from industry of which a good proportion is acquired on an industrial confidential basis. Such an activity is difficult to farm out, although instrument development required to sustain these activities is largely effected extramurally.

EMR has largely depended on industry to develop the instruments and carry out practically all the surveys required for the Federal-Provincial Aeromagnetic Program. This program will be superceded by the Federal-Provincial Uranium Reconnaissance Program which will also be contracted largely to industry. Where an instrument has been developed in-house, it has been readily passed to industry for secondary development to industrial production.

The Canadian Centre for Mineral and Energy Technology wishes gradually to eliminate positions as they become vacant in order to free financial resources for contracting out R&D. However, present T.B. guidelines do not permit use of salary funds for those purposes.

6. Shifting of research resources in a changing technical environment

The comments given on pages 19 and 20 of the 1968 Brief are still relevant. Some of the branches within EMR have provided additional information.

Geological Survey of Canada

The majority of Branch projects are completed by publication of a report and/or maps of a specific area or topic. Initiation of a new project for which no, or insufficient, new resources are obtained requires transfer of staff to the new project and either delay in publication of results, or in rare cases, outright cancellation of the project. Some recent examples are the speed-up in the Uranium Reconnaissance Program that required transfer of staff involved in both scientific support services and the geoscience base studies; similarly recent increases in the coal program have only been possible by transfer of staff from regional stratigraphic programs. Rapid and too frequent changes in program priorities delay or cancel publication of results judged to be of a lower priority, and at times result in morale problems of scientific staff who naturally wish to see their works published at an early date.

Canada Centre for Mineral and Energy Technology

As mentioned in the response to previous questions, CANMET has instituted a matrix management system with the priorities of projects being the responsibility of a program management team. This team has the authority to allocate resources to line organizations, and to contract out research (to the extent that resources permit) in accordance with the perceived priorities. Consequently, the specified objectives of contracted research are such that the results will complement in-house research in reaching project objectives.



### Earth Physics Branch

Resources are continually being changed from one project to another, in particular to undertake short-term problem-solving priorities in an effective manner, but with minimum disruption of on-going base activities. This is best done by a process for forward planning which is kept under continuous review by the Branch Management Committee. The difficulties have not been major to date, although there are some problems with individual scientists. These are not insuperable when changes take place within the same general program; they become more acute with major program shifts.

### Canada Centre for Remote Sensing

A 'high technological risk' area is that of sensor development. The process of prudently assessing possible lines of technological development is carried out by allocating a modest amount of resources as 'seed money' to various university and industrial research facilities. This is done in the form of contracts to explore specific areas of advanced development. Progress is reviewed at least twice a year. Unsuccessful projects are not carried out beyond this exploratory stage. Successful projects are transferred to a more permanent budget allocation. In either case, the corresponding amounts are re-directed to new areas of research.

## 7) Transfer of research results

Most of the general comments given on pages 30-32 of the 1968 Brief still apply, though there have been significant changes in the Department's functional responsibilities, in the published reports of the various branches, and in the way in which geoscience data are stored and made available to users both within and outside the Department.

The principal means of transfer of research results is through publications which provide a permanent record of the work of the department. Publications may be in the form of reports prepared in the branches and published as series by Information Canada; thus the Geological Survey, CANMET, Earth Physics Branch and the Mineral Development Sector issue series of reports dealing with their specialties. Many of these reports are exchanged with scientific institutions around the world and deposit copies are made available to Canadian universities and learned societies, thus facilitating information transfer. Some of these reports appear in abstract form in one or more of the external publications that provide an abstract service and so receive wide publicity. The Geological Survey also publishes a Report of Activities series which presents interim results for many of the Branch's more than 400 research projects. This is released several times a year and comprises more than 1,000 pages of printed text. The branches also offer notification services by means of which persons and organizations, including libraries interested in the work of the Department are informed of new publications. In addition, annual indexes of these publications are published by the branches. To permit rapid release of information, the Geological Survey has an Open File system. Unedited manuscripts, maps and reports are made available on demand at user's cost. CANMET publishes an annual Mines Memo which contains a summary of the work of the Branch for the previous calendar year. This report is directed towards the knowledgeable technical reader rather than the specialist.

All the branches and the Science and Technology Sector itself produce annual reports. These are listed in section 2.8.

In the Canada Centre for Remote Sensing technology transfer is achieved by requesting an early participation of the eventual users. The process usually evolves gradually from sharing of ideas and advice, to joint funding of development projects, and finally to the establishment of pilot projects.

Scientific conferences and publication of results in scientific journals remain very important vehicles for technology transfer, as do personal contacts. In addition written and oral communications on a wide variety of technical matters are handled by information specialists and other members of the departmental staff. Information is also transmitted to scientists from Canada and abroad who visit the Department's laboratories in various Canadian centres.

Most branches within the Science and Technology Sector have computerized storage and retrieval systems for earth sciences data and resource data. These data systems are designed to serve users both inside and external to EMR. They are indexed and co-ordinated through the Canada Centre for Geoscience Data, a new central support unit within the Department. This unit has been periodically compiling a National Index for Geoscience Data which provides source information and titles of reports and publications relating to all types of available geoscience data in all regions of Canada. This is done in collaboration with many provinces and federal agencies.

Data storage and information systems within the Department are tailored to meet specific demands. For example, a data-base system recently

inaugurated by the Surveys and Mapping Branch stores mapping information in a computer bank. This information, which can be rapidly processed into a variety of map types, is accessible to all interested agencies. The Earth Physics Branch operates remote digital seismic observatories (The Yellowknife Array, the Eastern Canadian Telemetered Network). By means of telephone or telemetered links between the remote stations and a dedicated computer in Ottawa, processing of seismic events (earthquakes or underground nuclear explosions) can be completed within 24 hours, and information regarding their location and character made available.



## 2.7 Research Policies

### Part (b) Units exclusively concerned with extramural research activities

None of the branches or units within EMR is concerned exclusively with extramural research activities. However, the Science and Technology Sector does have an office to co-ordinate extramural programs including the Research Agreement Program.

The Research Agreement Program has been discussed in Section 2.7, Part (a). In response to the questions in 2.7, Part (b) we can add the following statements.

1. The program of Research Agreements is designed to take advantage of the capabilities of a variety of disciplines and technologies, available in Canada, to facilitate the better use of our mineral and energy resources and to provide information on Canada's landmass.

Applications for support are considered by the Department on the basis of the potential significance that the results of studies will have on the Department's objectives.

2. The major factor in evaluating any project is its potential contribution to one of the stated Departmental objectives. Other criteria that are applied include scientific quality of the proposal, creativity, feasibility, competence of the investigator, suitability of the applicant's facilities, existence of similar or related projects, manpower training potential, the importance of developing the competence of the agency with whom the agreement is made, likelihood of stimulating further research, timeliness, and costs relative to probable benefits. In the final analysis, experience has shown, budgetary limitations and the increasing number of applications do affect the actual numbers of projects and amounts awarded.

Cost sharing and the proposed extent or nature of the contribution by the applicant organization may receive special consideration in some instances. Such arrangements are proposed by either the Department or the recipient organization.

3. Departmental specialists on the related topics are assigned as contact officers to maintain liaison with the investigators throughout the life of the agreement.

Reports of progress are required at the end of the year specified in the agreement; on the application for renewal of an agreement; and on completion or termination of the investigation.

SECTION 2.8      RESEARCH OUTPUT

- 1,2,3. Patents arising from research activities  
Books or journal articles arising from research activities  
Reports issued from agency and units

An up-dated listing of inventions and patents awarded or applied for is given each year in the annual report entitled "Activities of the Science and Technology Sector". The report for 1974-75 is in press and will be available soon. It lists over 120 inventions, about 80 of which have been awarded patents.

Bibliographies of in-house reports and publications, and monographs and articles published in scientific journals are given each year in the Science and Technology Sector Annual Report. In 1974-75 there were over 500 internal reports and about 350 articles published in the open literature.

For the Geological Survey of Canada in-house reports and branch publications include: Memoirs, Bulletins, Papers, Open File items, Economic Geology Reports, Miscellaneous Reports and Maps. For CANMET in-house publications include: Monographs, Research Reports, Technical Bulletins, Information Circulars, Reprint Series, Scientific Bulletins, Investigation Reports and Laboratories Reports. Earth Physics Branch has several series of in-house publications: Publications of the Earth Physics Branch, Gravity Map Series, Geomagnetism Series Reports, Geodynamics Series Reports, Seismology Series Reports, Geothermal Series Reports. Surveys and Mapping Branch in-house requirements are met by a series of Surveys and Mapping Publications, though maps and cartographic products form the bulk of their published material.

Reports of activities are prepared usually on an annual basis, by the Science and Technology Sector and its component branches. These are as follows:

Activities of the Science and Technology Sector, an annual review with full bibliography and directory of scientific staff.

Geological Survey of Canada Report of Activities

Part A: released in January and including reports based on the preceding field season.

Part B: released in June and serving as a publication medium for short scientific contributions from staff members.

Part C: released in November and designed to facilitate early release of significant data obtained during the field season and as a publication outlet for short scientific reports.

Geological Survey Annual Index of Publications

Mines Memo, an annual review of CANMET activities

Catalogue of Scientific and Technical Papers published by the former Mines Branch (since renamed CANMET) 1967-74, DS-75-16 (INFO) in press.

Annual Report of the Earth Physics Branch, submitted each year for the Canadian Geophysical Bulletin published by National Research Council.

Catalogue of Published Maps, an annual up-date of topographic, aeronautical charts, etc. available at the Map Distribution Office of Surveys and Mapping Branch

Annual Report of the Canadian Advisory Committee on Remote Sensing

Polar Continental Shelf Project, a compilation of titles and abstracts of scientific papers supported by PCSP. These compilations are not produced annually, but as occasion warrants. Two such reports have been published to date.

In addition, an illustrated Annual Report of the Department of Energy, Mines and Resources is published which gives an overview of the activities of all three sectors.



#### 4. Conferences

Conferences, symposia and seminars are an important means for transfer and interchange of scientific information and are vigorously supported by all branches within the Department. This support includes presentation of papers, assistance in organizing symposia both in Canada and abroad, and financial grants which contribute to organization expenses and publication of conference results. Several branches conduct a regular in-house seminar program in which their own scientists and occasional visitors present accounts of their recent work and results.

Grants by the Geological Survey of Canada in support of conferences and symposia amounted to \$16,050 in 1975/76, \$10,000 in 1974/75, \$4,500 in 1973/74, \$7,400 in 1972/73 and \$16,200 in 1971/72.

Staff of the Branch attend approximately 80 meetings each year that are related to geoscience activities and held in Canada, the United States and elsewhere. Many of these are on very specific subjects and participation is limited to one or two staff members. Larger numbers attend meetings with a broader range of interest and in particular as much support in the way of providing speakers and assistance in organization is given to Canadian conferences as possible.

Canadian meetings held on an annual basis that generally receive considerable Branch support include:

- Geological Association of Canada
- Prospectors and Developers Association
- Canadian Institute of Mining and Metallurgy
- Mineralogical Association of Canada
- Canadian Society of Petroleum Geologists
- Canadian Geophysical Union

In addition to the support given to these Canadian associations, mention should be made of the Branch's substantial support to the International Geological Congress held in Canada in 1972. The Congress meets only every fourth year and had not been held in Canada since 1913.

Among workshops or symposia organized in total, or in large part, by GSC staff are:

Basins and Geosynclines of the Canadian Shield,	Ottawa, 1970
Earth Science Symposium on Off-shore Eastern Canada	Ottawa, 1971
Workshop on Methodology of Mineral Resource Evaluation	Ottawa, 1974
Symposium on Permafrost Geophysics	Calgary, 1974
Palynology Workshop	Calgary, 1974
IEEE OCEAN '74	Halifax, 1974
CANMINDEX-M2 - workshop on development of files for mineral resources (jointly with MDS)	Ottawa, 1975
BENTHONICS '75 (International Symposium on Benthonic Foraminifera)	Halifax, 1975
American Society of Limnology and Oceanography	Halifax, 1975
Geoscience forums at Yellowknife and Whitehorse (with INA)	annual
Geological Association of Canada, Western meetings	Vancouver, annual

In the Canada Centre for Mineral and Energy Technology importance of communicating the results of research or sharing the benefit of their experience and expertise is recognized to be an integral part of professional duties of the staff. Thus perhaps as much as 20 per cent of staff time is spent in preparing and presenting scientific papers at meetings and conferences, organizing workshops and conferences, giving university courses and invited talks to professional societies and industry, and participating in a host of special purpose seminars and symposia.

Some meetings are recurrent. CANMET gives the lead in convening annual seminars for the Canadian Mineral Processors, Canadian Mineral Analysts, Canadian Carbonization Research Association and the Canadian Uranium Producers Metallurgical Committee and, at the same time, provides most of the technical input. There have been regular seminars and debriefing sessions in rock mechanics. Similarly, the results of research conducted in CANMET are communicated annually to the Steel Castings Research Institute, and twice yearly to the Canadian Galvanizing Research Association. During the past five years there have also been a number of single event symposia or workshops on such varied themes as operational research, waste embankment management, die casting, etc.

At the Earth Physics Branch the attendance and participation of their scientists at conferences is regarded as essential both for the development of the scientists themselves and for the transfer of information from government to extramural groups. National meetings which are attended and supported regularly are those sponsored by the Canadian Geophysical Union, the Canadian Association of Physicists (Earth Sciences Section), the Canadian Society of Exploration Geophysicists, the Geological Association of Canada, and others. In the United States, research papers are presented every year at meetings of the American Geophysical Union, the Seismological Society of America, the Society of Exploration Geophysicists, the American Association for the Advancement of Science and others. Internationally, the Branch has for many years supported the International Union of Geodesy and Geophysics and its component associations on Seismology and Physics of the Earth's Interior, Gravity, and Terrestrial Magnetism and Aeronomy. Staff members serve on the executives of these associations and of the Union itself, participate actively in their symposia and prepare national reports for Canada every four years. In 1974 EPB sponsored and hosted an international workshop on Electromagnetic Induction in the Earth and in 1975 supported a UNESCO sponsored conference in Canada on Induced Seismicity. The Branch conducts a regular series of seminars at which outside attendance and participation is welcomed.

At CCRS the Canadian Remote Sensing Symposium is held every 18 months. This is dedicated to the presentation and discussion of the most significant results of the national remote sensing program.

Surveys and Mapping Branch personnel disseminate information on research activities, projects and programs through the following organizations:

Major international organizations meeting every three or four years, but with annual working meetings, normally attended by S&M Branch senior personnel (3-12) to give papers:

Commonwealth Survey Officers Conference  
Federation International des Géomètres  
International Union of Geodesy and Geophysics  
International Cartographic Association  
International Society for Photogrammetry  
Pan American Institute of Geography and History

Major Canadian organizations meeting annually attended by S&M  
Branch personnel (3-12) to give papers:

Canadian Cartographic Association  
Canadian Council on Surveying and Mapping  
Canadian Institute of Surveying  
Canadian Symposium on Remote Sensing  
Provincial Land Surveyors Association (10 altogether)

Canadian organized meetings as required to impart specific knowledge  
resulting from Branch research:

Geodesy for Canada Conference  
International Symposium on Problems Related to Redefinition  
of the North American Datum  
North American Conference on Modernization of Land Data Systems  
Offshore Survey Technology Conference  
Space 'M' Seminars  
Canadian Hydrographic Conference

Major American organizations meeting annually and attended by senior  
Branch personnel with a number of papers usually presented by Branch  
delegates:

American Congress on Surveying and Mapping  
American Society of Photogrammetry

The Polar Continental Shelf Project has contributed funds to the  
symposium entitled "Thermal Regime of Glaciers" held at Simon Fraser  
University in 1975. It also helped organize and support a symposium on  
the Arctic sponsored jointly by the Geological Association of Canada and  
the Canadian Society of Petroleum Geologists in Saskatoon in 1973.



5. Transfer of scientific and technological data obtained from countries outside Canada to extramural groups

This is achieved through major contributions to the activities of the international scientific unions and their associations. EMR has sponsored several international meetings or workshops which have been attended by Canadian geoscientists from government, universities and industry as well as scientists from abroad. The Department has also co-operated with other Canadian scientific institutions in making substantial contributions to such major international projects as the International Geophysical Year, the Upper Mantle Project, the International Geodynamics Project, the International Hydrological Decade and others. For the Upper Mantle Project EMR co-ordinated the Canadian Program, prepared written reports regularly on its progress and results, and kept a catalogue of all Canadian publications related to the project. Scientists involved in these projects have had close contact with colleagues from other countries and in some cases have worked directly with them in the planning and execution stages. They have therefore been in a position to report on results from abroad as well as from Canada. The Earth Physics Branch supports the Canadian Sub-Committee on the International Geodynamics Project jointly with NRC; it also acts as the Canadian member of the International Seismological Centre, making its reports available to the Canadian community of geophysicists. A similar service is provided in gravity by the technical reports of the International Gravity Bureau.

Participation in international projects and meetings is important in earth science. Many of its disciplines are concerned with phenomena which are essentially planetary in character and therefore require study in the context of the earth as a whole before their impact and relevance to regional and local problems can be understood. Examples of such disciplines or phenomena are: faulting, folding, mountain building, plate tectonics, geological history and evolution, magnetic and gravity fields, earthquakes, solar-terrestrial physics, ocean tides, geodesy, and many more. The Department is well known for its international contributions in areas of this kind.

6. Individuals who trained in specialized fields whilst employed in EMR and who subsequently left and made important contributions elsewhere

The Geological Survey of Canada has assembled some statistics which are given below:

	<u>No. of Scientists resigning</u>	<u>to university teaching</u>	<u>transfer to other federal agencies</u>	<u>other</u>
1970	7	2	1	4
1971	5	3	1	1
1972	5	2	-	3
1973	9	1	3	5
1974	9	2	3	4
1975	12	-	7	5

Other branches have given examples.

Surveys and Mapping:

A staff member left the Surveys and Mapping Branch in 1970 to become Chairman of the Department of Surveying Engineering of the University of New Brunswick. Another left the Branch in 1972 to become Director of the Survey Department of Laval University. The former Dominion Geodesist was appointed professor of geodesy at Erindale College, University of Toronto.

Earth Physics Branch:

A former Director left the Branch in order to become a UNDP Project Manager in Southeast Asia. His specialized skills, developed while working in the Branch, are being used to supervise the establishment of a network of seismic stations in a number of countries in Southeast Asia. Of three staff members who have recently resigned one has taken up a university post in Canada, one has established a new laboratory in Australia, and the other has done the same in New Zealand.

Canada Centre for Remote Sensing:

A number of individuals have obtained their basic training via CCRS programs, and are now in user agencies. While there is no formal method of recognizing outstanding work in the field of remote sensing, it is a matter of fact that Canadian experts in this field are very highly regarded around the world.

7,8,9 Research teams with unique abilities  
Valuable research tools, facilities or processes recently added  
Impact of scientific activities and research

Geological Survey of Canada

The need for rapid response to new thrusts has resulted in the formation of research teams to undertake specialized programs or projects; examples are:

Uranium reconnaissance program, Uranium resource appraisal, Mineral resource evaluation group (Operation September), Project Appalachia, Data Systems group, Takla Project, Coal research team, Petroleum evaluation team, Coastal and nearshore dynamics study teams, Problems of radioactive waste containment, Permafrost-ground ice, Landslides.

Formation of the Atlantic Geoscience Group within the past five years has led to the organization of teams of experts to study various aspects of the geology of offshore Eastern Canada.

Many valuable research tools, facilities or processes have been added or developed during the last few years; some of the more important are:

Airborne gradiometer for geomagnetic surveys, Lake sediment geochemical survey technology, Computerized electronic navigation systems, Overhauser high sensitivity magnetometer, Radon gas monitor, Portable mercury detector for geological field applications, Facilities for isotopic geochronology in U/Pb determinations on zircon, High pressure experimental laboratory designed to investigate genesis of rocks at great depths below the earth's surface, Expertise in SCUBA techniques for seabottom investigations in Arctic areas, Computer based file for geotechnical data in urban areas, Light, portable drilling equipment for subsurface permafrost investigations, Huntex deep tow for marine seismic surveys properties, Electric rock core drill, Time-lapse underwater T.V., Scanning electron microscopy (use and evaluation).

Development of facilities at the Atlantic Geoscience Centre has led to establishment of the following new laboratories:

- a) Palynology sample preparation
- b) Sedimentary rock analysis
- c) Microfossils preparation
- d) Geochemical analysis of hydrocarbons
- e) Portable containerized shipboard laboratories

The activities of the GSC are of importance in meeting some of the principal objectives of government - to establish a better balance in the distribution of people and wealth between the regions of Canada, a more rational use of resources and the acceptance of new international responsibilities for sharing Canada's resources. These objectives depend to a considerable extent for their solution on comprehensive evaluations of available resources. Such evaluations depend on an extensive data base which must be continually expanded.

GSC has, in the interval since the last submission was made to this Committee, carried out extensive evaluation programs in the fields of: Oil and Gas, Coal, Uranium, Minerals. Such studies have a major impact on the Canadian economy because they are the basis on which government policy is built. The geoscience data on which such evaluations are made are, of course, of use in other ways. Much of this information has been made available to industry in the form of maps and reports of great use in directing exploration activities to more specific targets.

In 1975, GSC, together with other agencies of the Federal Government, prepared an assessment of the petroleum resources of Canada which, because of a greatly improved data base, was considerably more precise than that made in 1973 and published in "An Energy Policy for Canada". The importance of such estimates when determining Canadian export quotas for oil and natural gas is obvious. Similar on-going evaluations are being made for coal, uranium and other metals.



In connection with the Third Geneva Conference on the Peaceful Uses of Atomic Energy, held in 1964, the Geological Survey revised their original 1958 estimate of Canadian uranium resources. Officers of the Branch participated in the fourth world uranium resource assessment published in 1973 and in the studies in progress in connection with the imminent fifth report. The establishment in 1974 of the Energy, Mines and Resources Uranium Resources Appraisal Group brings branch expertise to bear on the problem of ensuring that there is at least a 30-year reserve of nuclear fuel for all existing and planned reactors in Canada.

During 1972 the Geological Survey undertook a crash project to provide an order of magnitude estimate of Canada's resources of copper, nickel, molybdenum, lead, zinc and iron. Such estimates are difficult to make because the deposits have diverse origin. Refinements to these estimates have been made and the information assembled forms a significant part of Energy, Mines and Resources' Mineral Policy Phase II & III documents which are responses to Cabinet directives directed towards developing a Mineral Policy for Canada.

In addition to evaluation studies, the Branch has continued to develop guidelines to improve the discovery of additional resources. Considerable advances have been made in the study of mineral deposits, an example is the exhalative theory for the origin of sulphide deposits - a theory which has direct application to the search for base metal occurrences.

Correlation of geological units is essential in developing criteria to assist in the search for additional resources, especially in the Precambrian Shield. Major advances have been made in isotope geochronology whereby the succession is established first in individual areas, and finally to provide regional correlation. As the bulk of Canada's metallic mineral wealth comes from the Shield, the value of such studies to industry in their search for new deposits is obvious.

The past decade has witnessed a dramatic increase in the importance of Transportation Corridors, especially those which may be needed to move potential oil and gas resources from the Arctic to southern markets. The Geological Survey has been called upon to initiate major programs to determine terrain capability, to identify sources of construction materials and to evaluate existing and potential terrain hazards. Such studies are essential to government in granting construction permits for such major projects as pipelines, but are also of importance in assessing the impact of resource exploitation in any part of Canada. The expertise available in the Geological Survey is well demonstrated by the secondment of a senior staff member as science adviser to the commission on pipeline routes presided over by Mr. Justice Berger.

Scientists of the Geological Survey are making a major contribution to the study of landslide hazards, especially those that occur in the sensitive clays of eastern Canada that underlie some of the most intensively utilized land in Canada.

The urbanization that began in the early part of the century requires that much more attention be given to the use that is made of the inhabited parts of Canada. Subjects of growing concern include natural hazards, waste disposal sites, and sources of construction materials. Geotechnical data for 28 urban centres have been collected, placed on magnetic tape and, in late 1975, are being transferred to microfiche for use by urban planners. Officers of the Branch are deeply involved in the nuclear waste storage program of Atomic Energy of Canada Ltd. and have made significant contributions to a study of the feasibility of underground containment in hard rock of solid nuclear wastes. The salt deposits of Canada are also being studied for the same reason. As nuclear power appears likely to play an increasingly important role in meeting Canada's energy requirements and thus in her economic future, secure waste disposal sites will be essential.

The internationally recognized marine geoscience program carried out by the Geological Survey strengthened Canada's position at the 1975 Law of the Sea Conference and has contributed to the assertion of our claim to offshore regions as well as giving credibility to our claim to manage offshore resources.

#### Canada Centre for Mineral and Energy Technology

There are groups or laboratories within CANMET appointed to monitor the observance of regulations. In some instances, the experimental equipment operated by these laboratories may be unique to Canada. Exceptional or unique facilities have also been built up by CANMET scientists with the vision to appreciate their responsibility to keep abreast of developments in the fields of mining and energy and to provide a focus in the nation for research in these disciplines. For minerals R&D special facilities are frequently used to solve problems for industry, universities and other Government departments on a cost recovery basis. Metal forming, automatic electronic analysis of minerals, X-ray television fluoroscopy applied to liquid metal flow, and residual stress measurement by X-ray are outstanding examples. In metal forming, certain of the equipment is unique in North America. As a result, requests from U.S. steel companies to test this equipment have had to be declined in order to accommodate contract research from Canadian steel companies and non-ferrous metal producers as well as the in-house programs. Work with the X-ray television fluoroscopy apparatus has led to the making of two 30 minute films dealing with the flow of liquid steel in sand moulds. By now, these films have probably been shown at technical meetings throughout the Western world.

With regard to energy, CANMET is the pre-eminent source of R&D expertise in Canada for coal, heavy oils and bitumen, flame and combustion technology and uranium ores. The Clover Bar laboratories in Calgary, for example, have innovated Compound Cyclone equipment for cleaning and upgrading

of Western coals which characteristically have high ash contents. The Ottawa laboratories have developed an intimate working relationship with coal producers and steel companies interested in coke and their efforts have been significant in the development of export markets to Japan which revitalized the western coal industry, hopefully in time to permit the adaption of western coking coals to the requirements of Ontario steel producers which are completely dependent on U.S. coal. In Ottawa unique facilities for thermal and hydrocracking of heavy oils and bitumen have led to the EXTENDOIL Process which has the potential of significantly lowering the cost of refinery products and increasing hydrocarbon reserves. Naturally further developments are proceeding in cooperation with the Alberta Oil Sands Research Technology Refinery.

Continuing research in pipeline welding, galvanizing, open-pit slopes, and solvent extraction, has in effect, created centres of expertise in these fields. There are other examples of what has been accomplished by sustained team research effort. But to present a few highlights is to provide an incomplete impression of the working scenario in the Branch. The diversity and the compass of this, perhaps, is better illustrated by the following partial list of more obviously recognizable agencies on whose behalf research, special investigations, tests or consulting work was undertaken routinely during the past five years: NATO, OECD, DND, NEB, AECB, AECL, MOT, DPW, RCMP, NH&W, IT&C, CTC, DOC, DREE, Royal Mint, National Museums, St. Lawrence Seaway Authority, CN, CP, Canadian Standards Association, International Standards Organization, Canadian Nuclear Association, Ontario Hydro, Quebec Hydro, Saskatchewan Research Council, Ontario Department of Environment, coal companies, mining companies, construction companies, steel companies, non-ferrous smelters, foundries, pipeline companies, aircraft companies, etc.



### Surveys and Mapping

The leading position of the Surveys and Mapping Branch resulting from its research activities in geodesy, photogrammetry, and cartography is well accepted in Canada and in the world. While the main thrust of the Branch is the production of maps and the establishment of a network of geodetic control points over the Canadian territory, mission oriented research has continued to be carried out by several small research teams during the last five years.

An outstanding example of the Branch contribution in geodesy has been the work done in the new field of inertial surveying. Inertial orientation based on the use of gyroscopes coupled with electronic registration was developed and refined by a Branch team. This has resulted in significant economies of orientation of survey networks. The same team participated with U.S. authorities in the development of applications of the Inertial Survey System (ISS) to surveying. This revolutionary survey tool has been used for the first time this year. Preliminary results indicate that production of survey points with the ISS may be 10 times greater than that of conventional survey methods.

The Branch has teams and individual researchers working in the following fields:

1. computer assisted cartography,
2. improved definition of the geodetic datum and of the geoid,
3. adjustment methods for large geodetic networks,
4. the theory of map projections,
5. adjustment methods for large blocks of aerial photographs.

Earth Physics Branch

Since 1968 several projects have involved research teams with unique abilities and the development of new and valuable concepts, tools or facilities. These have created significant impact on the advancement of scientific knowledge; some have been directly concerned with problems of economic development and others have not. Some examples are:

1. The team development of a draft earthquake hazard code for the location of suitable sites for nuclear reactors, at the request of AECS.
2. The development of a method to predict the depth of deep permafrost in the Arctic, essential for safe hydrocarbon resource development and production.
3. Paleomagnetic studies of the Precambrian in Canada to unravel major events in its tectonic history.
4. Studies of the paleolatitude distribution and time of formation of world reserves of pooled oil by paleomagnetic methods.
5. Geothermal studies concerned with evaluating geothermal resources in Canada.
6. Earthquake hazard studies in many parts of Canada including proposed Mackenzie Valley pipeline routes.
7. Geodynamic studies concerned with earth tides, polar motions, crustal plate movements and crustal deformation.
8. Development of special instrumentation and field techniques for making geophysical measurements in the harsh Arctic environment and on sea ice over the Arctic Ocean.

A major research facility which has been added since 1968 is the Geomagnetic Laboratory at Blackburn, Ontario on the eastern outskirts of Ottawa. This contains the new Ottawa Magnetic Observatory, and laboratories for the development, testing and repair of magnetic instruments used in the aeromagnetic survey program, in ground survey programs and at magnetic observatories. It also contains laboratories at which paleomagnetic research is conducted. Magnetometers and magnetic field recording systems which have been designed at this laboratory have been produced and marketed in many

countries by Canadian manufacturing companies. The 3-component airborne magnetometer system developed in this laboratory and its predecessor in Ottawa has been used for magnetic survey of Canada for the production of national magnetic charts. It has also been used for magnetic surveys over Iceland, the Scandinavian countries, ocean regions adjacent to Canada including the Arctic Ocean, and parts of the Pacific and Atlantic Oceans. There is only one other comparable 3-component airborne system in the world: the Project Magnet system developed in the U.S.A.

#### Canada Centre for Remote Sensing

Apart from the Centre's own scientists, research teams have arisen in universities and private industry. Universities such as Memorial, McGill, Montreal, Laval, Chicoutimi, Carleton, Toronto, York, Guelph, McMaster, Saskatchewan, UBC have acquired valued expertise in the development of technology or its application to specific problems. Industrial research teams have developed a unique expertise in the area of low cost advanced performance ground data handling systems.

Canada was the first country in the world to establish a ground receiving station for earth observation satellites. The Canadian system of data acquisition, processing and distribution is perhaps a model in the world in terms of efficiency and effectiveness.

Benefits deriving to Canada from the existing program fall into three broad categories: Scientific, operational and commercial.

In the scientific field, the benefits to Canadian universities and to industry have been mentioned above. Scientists from the major government departments involved with natural resources, agriculture and the environment are actively using remote sensing techniques as a valuable tool to further their investigations. Provincial departments with responsibility in these fields are also using these techniques and have established remote sensing offices or co-ordinating committees to make maximum use of available facilities.

In the operational field, the earth observation program has progressed through several stages since its beginning in July 1972. The first stage involved initial investigations and familiarization of potential end-users and service agencies with the new technology. While this activity never really stops, as new investigations are continuously started, several important application areas have entered the stage of demonstration projects. These include ice reconnaissance to support navigation in the Arctic and East Coasts, crop information systems to help assess major crops around the world as well as specialty or regional crops at home, forest inventory and management, forest fire assessment as well as a degree of prevention through mapping of hazardous combustible areas, snow cover mapping to support hydro power generation and help assess the danger of spring floods, rapid renewable resource mapping and environmental monitoring, particularly in Canada's mid-corridor and northern development areas, oceanography and coastal zone management, and map updating and correction, - to name a few of the more advanced applications. In addition, while this is not strictly related to the renewal of the agreement regarding the LANDSAT series of satellites which operate in the visible and near infra-red region of the spectrum, it must be pointed out for completeness that microwave technology developments now hold serious promise of applications in the area of all-weather ocean management and information systems to support Canada's jurisdictional responsibilities over its territorial waters.

In the area of commercial applications, the Canadian remote sensing program has been managed in such a way that private industry was given every opportunity to develop expertise in this advanced technological field. This has paid off at home and in the export area. At home, several industrial and commercial concerns are now in charge of aspects of the program ranging from maintenance of satellite imagery, to the interpretation of these data for commercial applications. These commercial concerns are or will be operating from locations such as Prince Albert, Saskatchewan or St. John's, Newfoundland.



Polar Continental Shelf Project

Work in the field of glacier physics has led to the development of techniques to determine the paleoclimatology of the Canadian Arctic from data acquired from boreholes drilled in the Devon Island Ice Cap. By reading and understanding past climatic cycles from extracted ice cores one has a basis for predicting future climate.

A unique facility recently developed is an ice laboratory for the study of ice fabric and composition. To our knowledge there is no other comparable laboratory in North America.

#### 10. Other measures of research output

Other research outputs arise from the geological and geophysical mapping programs of the Geological Survey of Canada and the Earth Physics Branch. EPB compiles at 5-yearly intervals up-dated charts of the magnetic declination over Canada and at 10-year intervals up-dated charts of the other geomagnetic components: dip, horizontal force, vertical force, etc. High-level aeromagnetic anomaly maps are also available for most regions of Canada and adjacent oceans, a Bouguer Gravity Anomaly Map of Canada has been produced and permafrost distribution maps have been prepared.

Geological Survey of Canada mapping programs include bedrock geology, surficial geology, low-level aeromagnetic and sea magnetometer maps. Index maps showing the current status of these mapping programs are available.

For the Canada Centre for Remote Sensing another measure of research output is its valued assistance to developing countries through CIDA and IDRC, or through support of United Nations activity in the field of peaceful applications of outer space.

## ANNEX 1

ENERGY R&D PROGRAMS  
AND SUB-PROGRAMS

<u>TASK</u>	<u>NO. OF PROGRAMS</u>	<u>NO. OF PROJECTS WITHIN EACH PROGRAM</u>
1. CONSERVATION	12	76
2. FOSSIL FUELS	6	91
3. NUCLEAR ENERGY	4	17
4. RENEWABLE RESOURCES	6	20
5. ENERGY TRANSPORTATION AND TRANSMISSION	2	36
TOTAL	<u>30</u>	<u>240</u>

Note: 1. A summary description of sub-programs and projects will be available in published form by end of year.

## ANNEX II

Extract from "1975 Assessment of Canada's Uranium Supply and Demand", a publication issued by Energy, Mines and Resources Canada—June 1976.

# 1975 ASSESSMENT OF CANADA'S URANIUM RESOURCES

## Measured, Indicated and Inferred Resources

The same methodology and terminology defined in the 1974 assessment<sup>(9)</sup> are used in this report. Earlier Canadian assessments were generally reported under the internationally agreed definitions of "reasonably assured resources" and "estimated additional resources". The definitions of these classifications and their relationship to Departmental resource definitions are shown in Appendix 2.

For policy purposes, i.e. assigning domestic allocations among producers, only uranium resources in the measured, indicated and inferred categories are included by the Department. Consequently in Table 1 below only resources in these categories are given. This assessment of Canada's uranium resources was based on a study conducted by the reserve assessment and resources additional to reserves sub-committees of the Uranium Resource Appraisal Group during late 1975 and early 1976. The assessment was done under two price categories, one at the estimated world market price in mid-1975 and the other at twice that price.

It should be noted that the resources shown are those recoverable under today's technology. The recovery factors may increase with improvements in technology.

It is most important to emphasize that the estimates in Table 1 of resources available at prices from \$20 to \$40 per pound  $U_3O_8$  are restricted only to the principal deposits in Canada. Data related to uranium resources in this price category are relatively limited since exploration and development efforts in Canada have been concentrated on identifying lower cost resources. Consequently, these estimates can be looked upon as an incomplete appraisal of Canada's resources in this price category. With the apparent expansion of uranium exploration activity in Canada in 1976, partly in response to increased uranium prices, estimates of resources in both price categories can be expected to increase.

The Uranium Resource Appraisal Group's assessments are not directly comparable with earlier assessments reported internationally for Canada because of differences in reporting classifications and the more strictly defined criteria used by the Uranium Resource Appraisal Group.

For example, because of the latter, some of the resources which had previously been classified as indicated are now in the inferred category. In this context then, it is important to note that the sum of the measured plus indicated plus inferred resources has continued to increase. It is also important to emphasize that data published in the 1975

Table 1

## 1975 Estimates of Canada's Recoverable Uranium Resources\*

### Short Tons $U_3O_8$

Mineable	Measured	Indicated	Inferred
Up to \$20/lb $U_3O_8$	82,000 (77,000)	107,000 (107,000)	226,000 (237,000)
\$20 to \$40/lb $U_3O_8$	14,000 ( 4,000)	22,000 ( 17,000)	111,000 ( 84,000)
	96,000 (81,000)	129,000 (124,000)	337,000 (321,000)

\* Figures in brackets are from the 1974 assessment using price categories of up to \$15/lb  $U_3O_8$ , and \$15 to \$30/lb  $U_3O_8$ .

After deducting 1975 production of 4,600 tons, the resources have increased by some 7.8% over those reported in 1974<sup>(9)</sup>. Part of the increase was due to a more extensive study of data on deposits in established mines and part to the discovery of new resources. There was little impact produced by increasing the assessment price because of the inflation experienced in Canada in 1975.

In making its assessment the reserve assessment and resources additional to reserves sub-committees applied appropriate mine and mill recovery factors and mine dilution factors to ore in the ground to arrive at the recoverable resources. These factors are dependent upon the characteristics of the orebody and the efficiency of the milling operations. In general, dilution factors of 10% were assumed except in special cases where lower factors were warranted. As a rule, for open pit operations higher recoveries are achievable than for underground operations where recoveries generally reach 75-85%. In a few instances, because of special circumstances, recoveries may be less than 75%. About 90 to 95% of the uranium in the mill feed is recovered in the milling operation.

NEA/IAEA study (8) for Canada, included estimates of prognosticated resources, by virtue of the NEA/IAEA definition of "estimated additional resources" (See Appendix 2).

## Prognosticated Resources

During 1975 the sub-committee on resources additional to reserves evaluated information gathered on prognosticated resources in and adjacent to the mineable uranium deposits and in geological extensions to these districts (i.e.—known uranium districts). Information was also gathered on speculative resources in a few other uranium-bearing areas where uranium occurrences of apparently significant importance have been identified. A number of additional areas where uranium occurrences are known will be considered during the 1976 exercise as will certain virgin areas which are considered to be favourable for uranium mineralization. The latest estimates of prognosticated resources are presented in Table 2. Resources in the speculative category will be reported in the 1976 assessment.



Table 2  
1975 Estimates of  
Canada's Prognosticated Uranium Resources  
(Short Tons U<sub>3</sub>O<sub>8</sub>)

<u>Mineable</u>	
Up to \$20/lb U <sub>3</sub> O <sub>8</sub>	168,000
\$20 to \$40/lb U <sub>3</sub> O <sub>8</sub>	<u>282,000</u>
TOTAL	450,000

Estimates of prognosticated resources have not previously been published by Energy, Mines and Resources, except in

an aggregated form together with estimates of inferred resources and defined as "estimated additional resources". In the 1975 NEA/IAEA report, it will be noted that there was a decrease in that part of the estimated additional resource category attributable to prognosticated resources. This decrease was due in large part to the more stringent criteria applied to the definition at that time.

Studies by the sub-committee on resources additional to reserves during 1975 have led to a substantial increase in prognosticated resources due partly to the favourable results of exploration programs during the last two years and partly to the inclusion of several new areas in the assessment. As exploration activity accelerates and the assessment of uranium potential expands to other areas, estimates of resources in all categories will undoubtedly increase.







FIRST SESSION—THIRTIETH PARLIAMENT  
1974-76

THE SENATE OF CANADA  
PROCEEDINGS OF THE  
SPECIAL COMMITTEE OF THE SENATE ON  
**SCIENCE POLICY**

The Honourable MAURICE LAMONTAGNE, P.C., *Chairman*

Issue No. 19

THURSDAY, AUGUST 12, 1976

**Nineteenth Proceedings on**

**The Study of Canadian Government and  
other expenditures on scientific activities  
and matters related thereto.**

(Witnesses and appendices: See Minutes of Proceedings)



THE SPECIAL COMMITTEE OF THE  
SENATE ON SCIENCE POLICY

The Honourable Maurice Lamontagne, P.C., *Chairman*

The Honourable Donald Cameron, *Deputy Chairman*

and

The Honourable Senators:

Asselin	Hastings
Bélisle	Hicks
Bell	Lang
Blois	Manning
Bonnell	Neiman
Bourget	Riel
Buckwold	Robichaud
Carter	Rowe
Giguère	Stanbury
Godfrey	Thompson
Goldenberg	van Roggen
Grosart	Yuzyk
Haig	

27 Members

(Quorum 5)

# Order of Reference

Extract from the First Report of the Special Committee of the Senate on Science Policy, presented on July 10, 1975 and printed as an Appendix to the Minutes of the Proceedings of the Senate of that day, and adopted by the Senate on July 24, 1975:

"The Committee, therefore, recommends that it be authorized to consider and report on Canadian government and other expenditures on scientific activities and matters related thereto;

That the Committee have power to engage the services of such counsel and clerical personnel as may be necessary for the purpose of the inquiry;

That the Committee have power to send for persons, papers and records, to sit during adjournments of the Senate and to report from time to time; and

That the Committee be authorized to print such papers and evidence from day to day as may be ordered by the Committee."

Robert Fortier,  
*Clerk of the Senate.*

# Minutes of Proceedings

Thursday, August 12, 1976.  
(29)

Pursuant to adjournment and notice the Special Committee of the Senate on Science Policy met this day at 9:35 a.m. the Chairman, The Honourable Senator Lamontagne, presiding.

*Present:* The Honourable Senators Bell, Buckwold, Godfrey, Lamontagne, Lang, and Stanbury. (6)

*Present but not of the Committee:* The Honourable Senator Lapointe. (1)

*In attendance:* Mr. Philip J. Pocock, Director of Research, and Jacques Ostiguy, Chief of Administration.

The Committee resumed consideration of its Order of Reference dated July 24, 1975 relating to the study of Canadian Government and other expenditures on scientific activities and matters related thereto.

The following witnesses were heard on behalf of

THE CANADIAN CHAMBER OF COMMERCE  
THE CANADIAN MANUFACTURERS' ASSOCIATION  
THE CANADIAN RESEARCH MANAGEMENT ASSOCIATION:

Mr. George A. Chapman,  
The Steel Company of Canada, Limited,  
Chairman, CMA R&D Committee;

Dr. Owen C. W. Allenby,  
Du Pont of Canada Ltd.,  
Past Chairman, CMA R&D Committee, and  
Chairman, Joint Committee drafting submission;

Dr. George L. Bata,  
Union Carbide Canada Limited,  
Chairman, Canada Research Management  
Association R&D Committee;

Dr. Gordon H. Segall,  
Canadian Industries Limited,  
Chairman, Canadian Chemical Producers  
Association R&D Committee;

Dr. Ron S. Stuart,  
Merck Frosst Laboratories,  
Chairman, Canadian Chamber of Commerce,  
R&D Committee;

Mr. G. C. Hughes,  
Director, Legislation, Taxation & Technical group,  
The Canadian Manufacturers' Association.

PHARMACEUTICAL MANUFACTURERS ASSOCIATION OF CANADA

Mr. W. M. Garton, President;

Mr. M. G. Fruin, Vice-Chairman of the Board;

Mr. G. Beauchemin, Executive Vice-President and Treasurer;

Dr. Ron S. Stuart, Merck Frosst Laboratories;

Mr. R. E. Everson, Director of Research.

On Motion by the Honourable Senator Lang, it was Agreed that the Joint brief presented to the Committee by The Canadian Chamber of Commerce, The Canadian Manufacturers' Association and The Canadian Research Management Association; the brief presented by the Pharmaceutical Manufacturers' Association of Canada be printed as appendices to this day's Minutes of Proceedings and Evidence. (See Appendices Nos. "33" and "34")

The witnesses made statements and then answered questions put to them by Members of the Committee.

At 12:30 p.m. the Committee adjourned until 2:30 p.m., Thursday, August 12, 1976.

ATTEST:

Patrick Savoie,  
Clerk of the Committee.

# The Special Committee of the Senate on Science Policy

## Evidence

Ottawa, Thursday, August 12, 1976

The Special Committee of the Senate on Science Policy met this day at 9.35 a.m. to consider Canadian government and other expenditures on scientific activities and matters relating thereto.

**Senator Maurice Lamontagne** (*Chairman*) in the Chair.

**The Chairman:** Honourable senators, we have several groups represented this morning from the private sector, but only two briefs. The Canadian Chamber of Commerce, the Canadian Manufacturers' Association, and the Canadian Research Management Association have prepared a joint brief. These various groups are represented here this morning by Mr. George A. Chapman of the Steel Company of Canada, who is the chairman of the CMA R&D Committee, and Dr. Owen Allenby, from Du Pont of Canada, who is the past chairman of the CMA R&D Committee and chairman of the joint committee drafting the submission. I understand that there are other members of the delegation, and I would ask Mr. Chapman to introduce the remainder.

**Mr. George A. Chapman, the Steel Company of Canada, Limited, Chairman, Canadian Manufacturers' Association R&D Committee:** Thank you, Mr. Chairman.

Mr. Chairman, honourable senators, may I introduce the other members of this delegation. On my right is Dr. Owen Allenby, past chairman of the Canadian Manufacturers' Association's R&D Committee, who was the chairman of the group who prepared our joint submission. Next is Mr. Graeme Hughes, Director, Legislation, Taxation and Technical Group, Canadian Manufacturers' Association. Along the wall, first is Mr. George Bata, representing the Canadian Research Management Association; next is Dr. G. Segall, representing the Canadian Chemical Producers Association, who subsequent to our actual submission had it approved by their board in order to add their name as one of the joint submitters. Next is Dr. Ron Stuart, representing the R&D Committee of the Canadian Chamber of Commerce.

**The Chairman:** We have also another separate group, the Pharmaceutical Manufacturers Association of Canada. I believe that we should hear the two short opening statements and have a general discussion subsequently. Is this agreeable as the procedure to follow?

**Senator Godfrey:** Except that if we are going to go through the CMA brief, it really does not fit in necessarily.

**The Chairman:** As the leading questioner, you can do that, but perhaps as we go along and there are questions of common interest we can do it jointly.

I understand from the past representations we have received from the Pharmaceutical Manufacturers Association that they have a rather special case, but they might

wish also to join in the general discussion. Is this acceptable?

We have, to represent this other association, Mr. W. M. Garton. I presume, Mr. Garton, that you have other members of your delegation present?

**Mr. W. M. Garton, President, Pharmaceutical Manufacturers Association of Canada:** Yes, Mr. Chairman. I have also representing us, Mr. Chairman and honourable senators, Mr. M. G. Fruin, the President of Eli Lilly & Company (Canada) Limited, and Vice-Chairman of the Board of the Pharmaceutical Manufacturers Association of Canada; Mr. G. Beauchemin, Executive Vice-President and Treasurer of the Pharmaceutical Manufacturers Association of Canada, on the regular staff, Dr. R. Stuart has also agreed to help us if any questions come up because he is familiar with both. That is our official delegation, senator.

**The Chairman:** Thank you very much. Now, Mr. Chapman, I understand that you have an opening statement?

**Mr. Chapman:** Yes, sir. Mr. Chairman, honourable senators, we are pleased to appear before this committee to have the opportunity of discussing our suggestions which were made in response to the report by this committee on a science policy for Canada. It is not my intention to summarize our submission, but I would like to highlight some of the points which we regard as most important.

The first point I would like to mention is part 8 of our submission on page 19, entitled "Incentives for Industry to Innovate." Industry in concert did not create a big fuss over the death of IRDIA. It was quite clear to us that IRDIA failed to become the broad-based R&D incentive program that was needed and hoped for. To some extent this failure was due to the grant for current expenses being referenced to a five-year base period which meant that only increases in R&D current expenditures were recognized. It did not take long for a plateau of such expenditures to be reached. This process was compounded by the economic recession of the early seventies.

Of course, one of the reasons we did not hold a wake over IRDIA's death is that we expected the government to immediately announce new and alternative proposals. In response to the invitation of your committee to comment on this and other areas of national concern, we have offered our own suggestions as to how an incentive program ought to be structured. We start from the position that industry prefers incentives which avoid lengthy processes of application and justification. We want to be responsible for taking the initiative for research and development as they are indicated to us by market forces. The pull of the marketplace must be recognized as the dominant factor influencing industrial innovation and the selection of projects. To carry out this needed research and development most effectively, we believe that all present incentive programs should be replaced by a tax deduction



sufficiently high to be a positive incentive. This is not without precedents in the Canadian tax structure.

When I referred to incentives I was referring to the cost of current operating R&D expenses. We believe, however, that the concept of an IRDIA credit system for R&D expenditures should be retained although available through corporate tax reporting, rather than a type of grant as was the case with IRDIA. In other words we continue to make the distinction between R&D expenditures of a capital nature and of an operating nature. In the case where companies are in a loss position there would be a rebate of the current R&D expenses but we suggest that such rebates should be restricted to companies which are Canadian-owned with an annual turnover of under one million dollars.

This, Mr. Chairman, is the heart of our proposal with respect to research incentives. In summary, we propose that a general tax deduction should be available as an incentive to all companies, irrespective of the type of R&D they are performing. We believe that such a general tax deduction has the advantage of being easily comparable with other allowable tax deduction, avoids cumbersome procedures of grant application and furthermore, because it is non-discriminatory, gives a much greater assurance of continuity which is essential for the long-range commitments required in research and development. The present unsolicited proposals aspect of the make-or-buy policy should be continued as a means whereby the government could meet the particular needs of smaller companies requiring support in their R&D efforts.

The second point I would like to deal with is the value of futures research and perhaps of planning generally. There is, as you may well understand, some reluctance by industry to agree to anything which might develop into detailed planning by government of the private sector. On the other hand, there is a recognition that when resources become obviously limited, as they have in the case of energy and many raw materials and foodstuffs, the need for planning, at least in the sense of setting objectives and priorities, becomes clear.

We therefore readily endorse the recommendation that the Canadian government and Parliament adopt an overall plan for science and technology based on longer-term projections and overall national R&D targets. We also see that there is merit in investigating the practicability of futures research and it is for this reason that we think the efforts of the Institute for Research on Public Policy in this regard should be given special attention. It is not that we doubt that futures research would be valuable if it could be done with any degree of utility; it is rather that the technical question of how useful or practicable or accurate such research might be is still an open question. This is the reason that we believe an inventory of futures research activities in Canada should be maintained and that practical input from industry and other outside groups should be sought in such research.

To summarize, while we agree that the government should attempt to coordinate its own planning for research and development, we cannot agree that the government should attempt to plan the day-to-day affairs of the private sector. We recognize that futures research may have an important role in any type of future planning, and we agree that new institutions must be devised which would permit the interface of various sectors of society in discussing and agreeing on policies and priorities relating to

Canada's future development. We think this modest first step is one which industry can and should support.

We warmly support the recommendation of this committee for the establishment of an association of parliamentarians, scientists and engineers, and we suggest that each House of Parliament should establish a Standing Committee on Science and Technology. We believe this is one institution which can only help to create an interest in, and knowledge of, science in Canada.

That concludes my opening remarks, Mr. Chairman. My colleagues and I will be happy to attempt to answer any questions.

**The Chairman:** Thank you, Mr. Chapman. I am sure that members of the committee are pleased to see that these three major private associations support so many of the recommendations that this committee made in 1972 and 1973, although there may be disagreement on some.

Next, I will call upon Mr. Garton.

**Mr. Garton:** Mr. Chairman, as you are aware, I am President of the Pharmaceutical Manufacturers Association of Canada. As I mentioned earlier, we are supported by representatives of the industry.

The Pharmaceutical Manufacturers Association, or PMAC, as I will refer to it, is indeed pleased to have this opportunity of appearing before your committee. We have already submitted a very complete analysis in relation to previous studies of science policy, industrial strategy, and innovation in Canada as they related to our industry in 1972. Then again in 1974 we submitted detailed comments and recommendations on volume III of this committee's report, which dealt with the subject of government organization as it should relate to science policy. We followed those submissions up with a paper on January 29 of this year to your committee, copies of which I have available for distribution. Accordingly, I do not intend to be redundant; rather, I intend to highlight two of the main points.

First of all, of course, some of the significant statistics contained in our brief of January 29, have been updated. A review of these updated statistics only tends to highlight and confirm the theme of our submission in that the research and development annual growth rate of the pharmaceutical industry is not keeping up with past performance, especially in view of recent inflationary trends. The main cause of this changed situation is outlined in the last paragraph on page 2 of our letter of January 29; that is, the modification to the Patent Act in 1969 which, for all intents and purposes, prevents an innovative company from benefiting from the fruits of its research. That is generally the theme of our submission.

Contrary to the commonly-held opinion that the pharmaceutical industry's research and development effort is insignificant in the Canadian scene, I should like to mention that our industry's expenditures in this area in the past 13 years have amounted to over \$240 million. Additionally, the pharmaceutical industry is first in Canada in terms of research expenditures as a percentage of sales, being 6.8 per cent of sales relative to 1.5 per cent as the average of all industries. As stated in our paper, the industry has an R&D to profits ratio of over 50 per cent, whereas the Canadian industry average is less than 10 per cent.

We believe that the legislation allowing for compulsory licences, which I referred to a few moments ago, was made without proper concern for its basic economic effects, although the Harley Committee, which recommended this

legislation, stated in the beginning of its report, and I quote:

No recommendations could be considered, which, although designed to lower drug prices in Canada might produce drugs of questionable safety or—

And this is the point I have underlined:

—or have a detrimental effect upon other aspects of the Canadian economy—

Being an international industry, pharmaceutical companies, understandably, view their future planned investments on an international basis. It stands to reason that the bulk of expenditures will be made in those countries offering the most favourable climate. A retrospective analysis of the effects of Bill C-102, which modified the Patent Act in relation to the pharmaceutical industry, has shown that the unfavourable climate created by such legislation has imposed a considerable negative influence on the growth rate of research and development activities and production facilities in the pharmaceutical industry in this country.

It also led to a dramatic reversal of previously favourable import-export trends, with a concomitant loss of employment for highly skilled, scientific and technically trained personnel, loss of government tax revenues, as well as detrimental effects on other service-related industries.

During the period of 1969 to 1972, imports increased at an average annual growth rate of 12.2 per cent, compared to an average growth rate of only 5.6 per cent for exports. In fact, in 1971, exports showed a decline of 11.9 per cent from 1970, which is significant in that it represents the first actual decline experienced in respect of exports of pharmaceuticals from this country in recent history. This trend to a lower exports growth rate continues in relation to imports.

Insofar as lower drug prices was a primary goal of Bill C-102, any review of its economic impact must include a look at what has happened to drug prices since that legislation was passed. There is evidence to show that the Canadian consumer and taxpayer has not benefited any more than previously through lower drug prices. In fact, when account is taken of the increased government expenditures associated with both policing the imports and convincing members of the health profession to use the cheaper products on the market, the Canadian taxpayer and consumer seem to come out the losers.

In conclusion, I should like to reiterate that the Pharmaceutical Manufacturers Association of Canada is most concerned with the trend that research and development in industry has taken, as outlined in our submission. We believe very firmly that government policies at both the federal and provincial level have created this unfavourable situation in relation to our industry.

That, Mr. Chairman, is a brief summary of the points contained in our previous submissions and some updating. In reading the report of the Economic Council of Canada entitled *Economic Outlook*, I came across a paragraph at page 37 which highlights the fact that the Economic Council of Canada believes, and has found, that there is not a significantly attractive climate in Canada for the innovative industry. Although it does not specifically pinpoint any particular legislation, it does refer to tariffs, government organizations, and R&D. On page 37 of that report you will find a fairly significant statement as to the government's policy in relation to innovation to the effect that

the fruits will go to the company that innovates, but that the climate in Canada is not favourable for innovation.

**The Chairman:** I am sure you will recall that this committee devoted a whole chapter of its second volume to this particular problem.

I would propose that the two briefs we have received be printed as appendices to today's proceedings.

**Senator Lang:** I so move, Mr. Chairman.

**Hon. Senators:** Agreed.

(For text of appendices, see pp. 19:28-19:65.)

**The Chairman:** I will call upon Senator Godfrey to lead off the questioning.

**Senator Godfrey:** Before commencing the questioning, Mr. Chairman, there are one or two observations I should like to make. First of all, I think it would have been very helpful had the committee had the benefit of being able to examine the report which has been prepared for the Department of Industry, Trade and Commerce, to which Mr. Jamieson referred in his evidence on May 12. That report was prepared by Gordon Sharwood. At that time, it was hoped that the report would be released before the summer recess, and Mr. Jamieson indicated that he had not as of that time made up his mind as to whether he would release it without comment or whether he would release it together with a statement as to whether or not he supported it.

I am sure that report will deal with all of the matters which we are going to be discussing this morning. When the report is published, it may well be that our witnesses this morning will wish to make further comments to the committee, or that the committee may wish to put further questions to these witnesses.

As I have been asked to be the lead questioner, Mr. Chairman, I propose to go through the brief in order, indicating as I go whether or not I have any comments or questions, following which other members of the committee can perhaps put any questions they wish on each section as we go through the brief. If that is satisfactory, I will proceed on that basis.

At page 2 of the brief, you talk about it being more meaningful to establish future goals, and the idea is not to prophesy for the future, but to invent it. This rather appeals to me. However, if you want to invent the future, do you not have to prophesy as to what is going to happen? Unless you try to prophesy what our energy situation is going to be 25 years from now, what our water resource situation is going to be 25 years from now, the amount of agricultural food production we will require, housing, and so forth, you cannot invent the future. You have to make some kind of prophecies in order to invent or influence the future.

**Dr. Owen C. W. Allenby, Du Pont of Canada Ltd., Past-Chairman, CMA R&D Committee, and Chairman, Joint Committee Drafting Submission, The Canadian Manufacturers' Association:** The first chapter, of course, should be recognized as being almost a theme chapter. The whole purpose of R&D is to look at the future. We have to decide what we will need in the way of housing in 1985, what we will need in the way of energy, and so forth. I think the government of the Province of Quebec has decided that we are going to need tremendous amounts of power by 1985. We underwrite that sort of forecasting because it



is the sort of information that industry needs. But we do make a distinction between that type of forecasting and what has come to be known as normative forecasting, that is that you invent a future form of society and I think that Galbraithian economics has a bit of that flavour, because I do not believe that we have enough experience, and being a horizontal society rather than a vertical society we have many views expressed by individuals. When we come to the point of forecasting the kind of society that we ought to be, a society that might actually be in conflict, as we have noted here, industry would find it extraordinarily difficult to work properly in such a society. If you read books on the future, and Kahn's is the latest, *The Next 200 Years*, which has just appeared on the bookshelves, you get the impression that it's fun to read because there are a lot of interesting things in there but when you look at the options that are open ranging all the way from Utopia to the complete collapse of Professor Calhoun's "Mouse Universe"—a rather famous experiment which he carried out at the University of Maryland—it ranges from Utopia to calamity. Then you have to try to sort out the influences which are meaningful, many of which we do not understand and many of which we cannot even forecast. But perhaps we can think about them. There are great dangers in that type of forecasting and that is the only danger point we raise. We did not take issue with the whole question of demographic projections, the forecast of the needs of a nation quite apart from the kind of society we want to structure.

**Senator Godfrey:** Mr. Chairman, I do not have any further questions on the first section, that is up to page 4 of the brief.

**The Chairman:** Any other questions on futures studies? I have a number, but I will pass.

**Senator Godfrey:** Going on to the second section, my only comment there is on the long-range planning of government R&D activities.

**The Chairman:** Excuse me just a moment, I want to explain why I have passed. It is not because I am not interested, but we intend to take your views here into very serious consideration. We intend to have at least one special and intense session on futures studies and I think it would be rather awkward this morning to mix the two because we have so many things to discuss on science policy. So we might as well leave that other area, which I still believe is very important, for future consideration.

**Senator Godfrey:** Then on the second section starting at page 5, all I have to say is that I heartily agree with the statement starting at the bottom of page 5 that

If we are not to squander the nation's limited resources, Canada must have a long-range plan for allocating these resources, reconciling conflicting views—

I think that ties in with what has been said previously, and I do not have any further questions or comments on that second section.

**Senator Stanbury:** I have just a comment. Again it seems to me in line too with what we have been hearing from the various agencies of the government in the last few days. There does not seem to be any real disagreement. There may be differences in method and extent and where the resources can come from, but I do not think there is any real conflict.

**Mr. Chapman:** Could I just make a comment, Mr. Chairman? I believe this committee might be extremely interested in two bills presently before the United States House of Representatives and one before the United States Senate that touch very deeply on this area. They were introduced, I believe, in June of this year. The one in the House was introduced by Mr. Symington, and I believe that you should take a look at it. It is called the National Materials and Research Organization Act, 1976. I believe that will be a very strong policy if it goes through and every indication we have is that it has a good likelihood of being passed. I have a copy of the House bill which I can leave with you.

**The Chairman:** Well, we have very good relations with the American Congress. Are you referring to the father or to the son?

**Mr. Chapman:** I am not sure which one it is.

**The Chairman:** Because the son, Mr. Symington even appeared before this committee, so I am sure we will get all this material. Mr. Mosher was also before this committee and we met him twice in Washington. I knew that this was coming. I think that our director of research, Mr. Pocock, has already received a lot of literature on the new set-up that they want to establish in the United States. As a matter of fact I think it was in our third volume that we said that the United States had destroyed their central machinery and their attempt at planning their scientific activities in the government, and we did forecast at that time that they might come back, and they are coming back now.

**Mr. Chapman:** This certainly appears to be a very strong rebuilding tool.

**The Chairman:** Just one comment, Senator Godfrey, and I just want to ask if you really regard or if you are convinced—and my comment is related to page 6 about this Canadian Association of Parliamentarians that we had proposed in volume 3—and you are convinced and your group is convinced that this could be a very useful operation.

**Mr. Chapman:** Yes, I believe so, Mr. Chairman. It certainly could be a forum for a very free interchange which has not been available in the past.

**The Chairman:** I just wanted you to underline that point.

**Senator Godfrey:** Then in the third section which you start off at page 7, and I must say that I agree with most of the statements made on page 7, you say:

The implication that, because currently the percentage is at about half this level, we therefore have a "Mickey Mouse" technology development effort in industry, suggests a total misunderstanding of the purpose of new technology.

I agree with that. And also with your statement that:

"Too much is made of comparisons of the level of Canada's research effort with that of other countries. Suggestions that, as one of our national goals, we should double or triple our R. & D./GNP ratio, in the expectation that this will give our economy a mighty stimulus, are ill-founded.

The rest rather follows along the same lines and I do not find anything personally to take exception to there. Also the fact that we should be more concerned with the skills

and technology that come with foreign investment rather than with the source of funds—I am rather inclined to agree with that too. We would welcome “A policy which welcomes a selective importation of technology into Canada, will provide one step towards a solution of Canada’s industrial woes.” That is only one step.

Now, to go on to page 8 where you refer to the fact that:

Comments made by one of the participants in the original discussions held by the Senate Special Committee on Science Policy, are as valid today as they were then.

There you refer to comments made by one of the participants in the original discussions held by the Science Committee on Science Policy—which goes back to the previous committee, I presume 1970, or whenever it was you made your submissions—and you say they are as valid today as they were then. You talk about the world leadership and reduction of tariffs being equitable tariff levels among other producing countries. I get the impression that our negotiators at GATT and so on are fairly hard-nosed and are doing the best they can. There have to be some kinds of trade-offs; if you are going to export, which is very important to Canada, you must import, and something may suffer from the imports. Are you suggesting that we have not been well represented in these negotiations?

**Mr. G. C. Hughes, Director, Legislation, Taxation and Technical Group, Canadian Manufacturers’ Association:** We do not represent that. We are cautioning. We have had dealings with the Department of Industry, Trade and Commerce and we have tried to follow this carefully, and they suggest to us that if there is a bias it may be in favour of giving away more than we can afford to. I would put it no higher than that. This first paragraph should be read as a caution, that while we believe in freer trade it should be on the basis that Canadian manufacturers do not lose their share of the domestic market.

**Senator Godfrey:** In the second paragraph you say, referring again to 1970:

High rates of taxation and anti-combines legislation which hinders an effective response to small-scale problem.

Let us discuss the high rates of taxation. On reading this brief I get the implication that you still have the same high rates of taxation now that you had in 1970, and therefore the criticism now is as valid as it was then. Is that what you are trying to imply?

**Mr. Hughes:** I agree with the inference that that is clearly not true. I have forgotten the date, but I am fairly sure it was after this was originally written, when Mr. Turner introduced the tax incentives for the manufacturing processing centre and it went down to 40 per cent.

**Senator Godfrey:** It reduced the rate of corporate tax to 40 per cent.

**Mr. Hughes:** Yes.

**Senator Godfrey:** Furthermore, which is even more important, particularly to capital-intensive industries—and in your work with the steel companies, if anybody knows this you do—it was the fast depreciation write-offs, the 50 per cent, that has been enormously beneficial to industry since 1970. Is that not true?

**Mr. Chapman:** Yes, I do not think there is much question about that.

**Senator Godfrey:** I do not have the clipping, but it was referred to last week in the *Globe and Mail*, where there were second quarter profits of \$30 million and taxation at about \$1,100,000, about a 3.5 per cent rate.

**Mr. Chapman:** Extremely low.

**Senator Godfrey:** Because of that tax break on fast write-offs?

**Mr. Chapman:** Most definitely. We are in the middle of a billion dollar expansion program.

**Senator Godfrey:** So the tax changes since 1970 have been enormously beneficial to industry, yet that is certainly not the impression I get from your brief, in which you say it is as valid now as in 1970, without any reference to that. Would you like to comment on that?

**Dr. Allenby:** I think when we were talking about high rates of taxation we were not suggesting that we were looking only at the industrial scene. I think a high consumption of GNP, a portion of GNP, by government ultimately comes out of the taxation system; that is where the money is derived. Therefore the national tax load, which includes individuals from whom savings ultimately can be invested in industry, is what we meant by high rates of taxation. Perhaps the confusion is in putting it in with that industrial statement and it was distorted.

**Senator Godfrey:** You certainly confused me. When I read it I could not believe it. I wondered whether my mind was going.

**The Chairman:** Perhaps not your mind but your memory.

**Senator Godfrey:** I usually cannot remember anything that happened yesterday, but I do remember that the government nearly fell in 1973 on the budget, which helped industry enormously, including industry represented by the chairman of this delegation.

**Senator Stanbury:** That was the invention of the word “rip-off.”

**Mr. Chapman:** I believe that one started a little earlier.

**Senator Godfrey:** Next you refer to anti-combines legislation. You say it hinders an effective response to small-scale problems. As far as I know, there have been only three cases of combines with respect to mergers. One was the Eddy Match case, which goes back to the late forties, in which there was a conviction on monopoly; then there was the Canadian Breweries case. There was a third one, but in any event they were found not guilty. What exactly are you referring to?

**Mr. Hughes:** I think once again we are referring in a cautionary vein to legislation which, despite the three cases to which you refer, industry deems they had an inhibiting effect, notwithstanding the number of convictions under the criminal law as it was. Industry has said repeatedly—and this is the vein in which this should be taken—that the combines legislation should be amended to promote rationalizations or export agreements or mergers when the market deems that to be appropriate. The fact is that industry perceives that the combines legislation did not have that effect; it had an inhibiting effect. Of course, since the writing of this, the department has come down with reports, which we are reviewing, and which seem, in general terms, to be extremely satisfactory, and to be



achieving precisely what is in industry's mind, but which was not known to us when this was written.

**Senator Godfrey:** I remember now that the third case was the Irving Newspapers case, in which there was a Court of Appeal decision. I have always felt that industry exaggerated the effect of the combines legislation. You are not suggesting that Canadian Pacific should be allowed to take over Stelco and amalgamate with Algoma Steel, are you?

**Mr. Chapman:** No, I do not think that is what we are suggesting at all. I know from my own position that quite often you have to think about this before you think about turning around to do something; you have to think whether you are going to run into that problem. I can think of cases where possibly joint research should have been carried out, but because of the fear of getting into this combines legislation it has been avoided. That has happened within my industry with three major companies.

**The Chairman:** Have you tested that with the combines people?

**Mr. Chapman:** I am not really sure in that case. In my own case there are three major steel producers in Canada who could be involved in the Mackenzie Valley oil pipe line pipe material. I know that those three companies have carried out independent research on it. To me that is, in a way, a bit of a waste of money. I think we could have carried it out jointly much better, but had we done so I am not sure that we would not have got stuck somewhere along the line.

**Senator Godfrey:** Did you go to your lawyer and ask him?

**Mr. Chapman:** Yes, we have in some cases.

**Senator Godfrey:** Perhaps I should say that my firm acts for Dominion Foundries.

**Mr. Chapman:** They are not one of the people who are competing for it.

**Senator Godfrey:** But you do have joint things on research in the steel industry. There is something called FERA.

**Mr. Chapman:** Yes.

**Senator Godfrey:** I presume you went to lawyers, who told you that that was perfectly legal. You also have something called CSSBI to find ways to reduce the cost of the steel-making process; that is joint.

**Mr. Chapman:** That is certainly a major attempt. There is one other that I know of, which is the Canadian Carburation Research Association, which has been carrying out joint research for many years in co-operation with the Department of Energy, Mines and Resources. I believe that at the time it was set up it was felt that they could justify it on the basis that no individual could afford to support such a facility, and that a joint facility made most sense. That is still operational; it is a very good example, and has in many cases been used for co-operation between industry and government.

**The Chairman:** What about the Canadian Pulp and Paper Research Institute? It has not been supported by the government and it covers the whole pulp and paper industry. Surely this is viewed by the government as legal.

**Mr. Chapman:** That is very different from two or three companies co-operating; it is the total industry.

**Senator Godfrey:** I know Jim Younger very well, and I rather doubt he would give you that legal advice.

**The Chairman:** We are not trying to go after you, but I think this is an important illustration.

**Senator Godfrey:** I don't want to be a bogeyman.

**Dr. Allenby:** I believe a major distinction must be made between industries in Canada which are competing for the Canadian market, which is the basis of the anti-combines legislation, and industries such as pulp and paper, which largely export, where the competitive problem is much different.

**Senator Godfrey:** But you did have a joint venture with Dofasco in connection with painted steel.

**Mr. Chapman:** That is a jointly-owned company, but the research and product development was done entirely separately.

**Senator Godfrey:** But it is a joint getting-together; you gained economies of scale, and so on, I presume.

**Mr. Chapman:** I believe that was done simply as a means of introducing a product into Canada which would not have otherwise been produced. I am sure that it was not meant to eliminate competition in any way. I am sure both companies would be very willing to sell that company off if they could get an independent person in the market, because it is by no means a main line of business.

**Senator Godfrey:** That is an illustration of a joint venture which was not inhibited by law. However, I do not want to belabour the point.

**Mr. Hughes:** Perhaps I might supplement my point. In a sense the proof of the pudding is in the recent report from the Department of Consumer and Corporate Affairs on stage two of the competition policy. If you read that report you get the quite clear impression that there is a need for a reversal in orientation of competition policy, that what is needed is one which is dynamic and flexible, which will allow a corporation to do what the market here or abroad dictates, with appropriate guarantees for the public interest. I put it to you that the proof of the pudding is that the department's independent report is one that takes this position, and it supports what we are saying here, that the combines legislation as presently written does have a hindering effect. If you talk to departmental officials you will, of course, get a different view, because they will say, "You could have come and talked to us about that." This is particularly so with export agreements, because they will then say that not one export agreement has ever been prevented. However, that is that side of the coin. You go to industry and ask them if they have tried to get export agreements and they say they have not. You ask why, and they say it is because they perceive they cannot do it under the combines legislation, so that the act has in fact a hindering effect.

**The Chairman:** Perhaps through lack of consultation.

**Mr. Hughes:** Perhaps.

**Senator Godfrey:** Maybe it is through going to the wrong lawyer.

**The Chairman:** Are you looking for a client?

**Senator Godfrey:** No. We already have one of the three in the steel business, so we cannot take another.

**Senator Bell:** Before we leave page 8, perhaps we could just cover the tariff part. I was wondering if this might be a good summary. I am thinking back to when Dr. Tory was trying to get the National Research Council started, and there is an excerpt I would like to put to you for comment:

The value of a scientific discovery may be so enormous that the dividends are hard to calculate. The case of Canadian magnesite is an example.

Magnesite is essential to the production of steel. During World War I the traditional supplies of magnesite from Austria were cut off. It became necessary to make use of relatively impure Canadian magnesite to line the hearths of our country's blast furnaces. The war over, the higher quality and economically more viable Austrian magnesite again became available, threatening a shutdown of the Canadian mines. The companies lobbied the Canadian government to place an import duty on this foreign magnesite. In a rare show of wisdom, the Minister of Finance of the day offered instead to provide a grant of \$25,000 to the National Research Council, which was then without laboratories of any kind, to finance an investigation of the companies' technical problems.

For Dr. Tory and his workers this was a unique opportunity to demonstrate the value to Canada of scientific research... Scientific research had been shown to be a more powerful weapon than tariffs, and an important industry had been established on a sound economic basis. The merits of government co-operation with industry in research and development had been amply vindicated.

Tory was later to state that a government department of science, industry and commerce "could in a few years be made to mean more to industry than all the petty tariff changes about which there is so much agitation".

That was a hopeful point of view on Dr. Tory's part, but I would like to hear your comments on this, because there have been other examples. I chose magnesite because it is important in steel manufacture.

**Mr. Chapman:** I do not believe that is true any more.

**Senator Bell:** It is not? Because we are not keeping up with later developments? It is the theory in which I am interested. If our research keeps developing and we keep ahead of the market or keep ahead of our competitors in other countries, is that not really where research puts whatever company it may be out front?

**Mr. Chapman:** To some extent, Senator. However, I believe that the real crux of that type of arrangement is that within Canada—I'm speaking for the steel industry now—we have to select our areas of expertise in which we can maintain world leadership in an area. I do not believe that we have the resources to say that we are the experts in the entire steel business. We have for many years been experts in the iron-making part of the process, out of which this developed. I believe that we are still probably one of the forerunners in development in that area and I suggest that probably a third of our resources would go toward that means. In my opinion if we select areas such as that, we can have a great impact, but if we try to spread our resources in an attempt to cover it with a blanket, I believe we would lose in the end because we could not

afford the required expertise. It is just unbelievable, the number of various talents needed to stay on top of an area such as that. It has got to the point now at which our computer people are as important to blasting operations as are our metallurgists.

**The Chairman:** This raises a fundamental question, it seems to me, in the sense that really with respect to the technology—and I agree that we cannot produce all of the technology that will be used in Canada, but if we rely too exclusively on imported technology we are bound to have, it seems to me, weak industries in Canada which will need tariff protection. On the other hand, if we are good performers in the field of innovation, and select areas, as you say, and develop a world market for these few products, we will have a much stronger industry, which will rely much less on tariffs.

**Mr. Chapman:** Yes.

**The Chairman:** In my opinion, from that point of view the manufacturing industry in general in Canada has not been very innovative, according to all the information we have.

**Senator Godfrey:** I must say in defence of the steel industry, are they not the most efficient in the world in certain areas?

**Mr. Chapman:** Yes, sir.

**The Chairman:** But we are discussing the CMA now.

**Senator Godfrey:** Yes, but it illustrates your point, which is very valid. If you do concentrate on special areas of expertise and spend the money on research and development, which the steel industry has done, becoming the most efficient in the world, you do not need tariff protection.

**Mr. George L. Bata, Union Carbide Canada Limited, Chairman, R&D Committee; Canadian Research Management Association:** As an additional comment, I would be concerned with respect to putting tariffs and scientific research into opposition with one another. They are just various ways and means to sell a product. If you have a unique product which has no competitor and you have arrived at this new product through scientific research, then it really does not matter at all, because someone needs that product and will pay the price for it and there is no alternative source. However, if you are competing with a commodity and have to ship it to greater and greater distances and have a small Canadian marketplace and are already at the limit of your competitiveness because of your costs, tariffs matter very little. So it is not a "neither-nor" situation. This is very specific to individual cases, and for all these unique products costs or tariffs are just components in the sale.

**Senator Bell:** I take your point, but would you concur that tariff is not the immediate, quick answer when one is tempted to throw up one's arms in such situations?

**Mr. Bata:** In the long run, tariffs are not a very good approach to competitiveness, but it is often a crutch and if other people are using this crutch we may have no other choice. An example in point might be the case of finished products versus raw materials. When you look at the U. S. market, it is extremely easy to sell raw materials to our friends south of the border, but when it comes to a finished product, you immediately perceive a tariff which might be *ad valorem* and you quickly decide it is not even worth



considering the very situation because the biggest potential market when we can afford shipping is closed to us. This is the type of case in which tariff comes in. There is no way that we can research ourselves out of this kind of arrangement.

**Dr. Allenby:** Mr. Chairman, I think a point that we should not lose sight of is that we are asking for equitable tariff treatment. I can think of a tariff situation with respect to polyethylene, although I am not up to date this year. However, polyethylene can be shipped from the United States into Canada with a duty of 7 per cent, and if Canadian industry attempts to ship it into the United States the duty used to be 22 per cent. I am not sure what it is at the moment, but that is the type of situation which works against achieving a proper scale in Canada for a plant of our own raw materials to feed into the North American economy.

**Senator Bell:** What is the reason for the discrimination?

**Dr. Allenby:** The United States government feels that it wishes to support its own industry.

**Senator Bell:** Is that something to do with branch plants?

**Dr. Allenby:** No.

**Senator Bell:** In some cases might it be?

**Dr. Allenby:** I doubt if the United States government thinks of it in that way.

**The Chairman:** I suppose it is difficult for them to answer on behalf of the American government.

**Dr. Allenby:** It is a common policy.

**Senator Buckwold:** I would prefer the long-term policy of the American government.

**Senator Godfrey:** At page 9 of the brief, and again you are quoting from 1970, you state:

High taxes on building and construction materials which in combination with high construction labour rates and the scale factor result in investment cost per unit of capacity being the highest in the world.

Since 1970 there has been a very substantial decrease in the tax on building materials. In 1974-75 wasn't it reduced from 12 per cent to 5 per cent?

**Mr. Bata:** That is right.

**Senator Godfrey:** It is not the same, then, in 1976 as it was in 1970.

**Dr. Allenby:** You will notice that we use the words "in combination with." The taxes on building and construction materials may have gone down, as you suggest, but labour has sky-rocketed and, as a matter of fact, in Canada today we are amongst the highest labour rates in the world.

**Senator Godfrey:** I am only arguing with the implication in the brief that it is as valid today as when this was originally written in 1970 and I question whether it is valid, because the Canadian government did respond to the question of high taxation by reducing it from 12 per cent to 5 per cent and in some cases eliminating it completely on construction equipment.

**Mr. Bata:** If I may comment, senator, it is a question of ascending the stairs with your left leg higher and your

right leg lower and changing positions so that your right leg becomes higher and your left leg lower. In the meantime the scale problem became worse than before; the labour problem became worse than before. However, I agree with you that taxation on construction materials has been reduced overall. The combination of these effects, which is the gist of this paragraph, effectively seem to have remained the same.

**Senator Stanbury:** But it is a little unfair, when speaking with government representatives, at least those who have responsibility in the taxation area, to combine the tax area over which they may have some responsibility with the labour area, over which until wage and price controls were introduced we had none. It is the manufacturers and others who had the responsibility for negotiating those rates.

**Mr. Bata:** May I respectfully ask who prints the money?

**Senator Godfrey:** The public.

**Senator Stanbury:** We could get into a long argument with respect to that, I suppose.

**Senator Buckwold:** In my opinion, in fairness to those who presented this brief, they are really pointing out that the costs are high, and, in my opinion, our committee is being picayune in zeroing in on this with respect to building materials from the point of view of taxation. On the other hand, inflation has more than compensated for that with a high rate, higher than many nations. I, for one, accept the fact that our costs are high.

**Dr. Allenby:** I believe the senator has made a point and it is a proper one, with which I agree; that is correct.

**Senator Godfrey:** I am sure that you are willing to accept any corrections as factual.

**The Chairman:** I am sure that everyone will appreciate and agree with this wonderful background. I wish to say, though, that we are not provided with this concept every day in Parliament.

**Dr. Ron S. Stuart, Merck Frosst Laboratories, Chairman, R&D Committee, Canadian Chamber of Commerce:** I would like to make one point: In spite of what people say, we are not competitive with those with whom we have to compete, either taxwise or costwise.

**Senator Godfrey:** I want to come to that. You say we are not competitive; what about the United States?

**Dr. Stuart:** We are not competitive with the United States on taxes on exports by a country mile.

**Senator Godfrey:** On the domestic tax in the United States?

**Dr. Stuart:** I am talking about tax on export goods.

**Senator Godfrey:** I attended the meeting of the Canadian Tax Foundation in the fall of 1973 and we had a paper presented by Dr. Peggy Musgrave on that very question. She pointed out that the DISC situation in the United States, which is the Domestic International Sales Corporation which was created by the United States government to encourage exports, relieved in fact something like \$600 million in taxes for the American companies and only increased their exports by \$300 million, which was not a very good bargain. Her conclusion was that the reduction

in the corporate taxes originally introduced in 1972 in effect offset the DISC program in the United States and that we were competitive.

**Dr. Stuart:** That may be as she said it, but as I talk to our accountant, who makes up our tax situation both for Canada and the United States, there is a vast difference between the two; there is no question about that.

**Senator Godfrey:** Her conclusion was that the export balance resolved itself to approximately the original position. That is, they reduced theirs, we reduced ours and it was a saw-off and, in effect, it did not affect the trade. She is the expert, not I.

**Dr. Stuart:** I think, also, that the industrial associations speak of reviewing this corporation business.

**Senator Godfrey:** It sounds like a bad bargain.

**Dr. Stuart:** But the industry is finding that, so there must be something.

**Senator Godfrey:** Yes; \$600 million for industry in the United States. One thing about which I am very curious is that you refer to the scale factor in construction.

**Mr. Chapman:** It is a very significant factor, sir; there is an economy of scale, which is based on market size and with the Canadian market in comparison to the United States being roughly 10 per cent, the scale factor is immediately a major problem for the steel industry and I suppose many other industries fall into exactly the same situation.

**Senator Godfrey:** I am referring to construction costs only.

**Mr. Chapman:** Yes, to build a plant to produce two million or four million tons the costs certainly are not double, but the market size you are looking at is a factor of ten. So this becomes a very significant aspect. This is one of the reasons that our new Lake Erie development project was postponed originally. It is also one of the reasons that it is going to start up for the first few years probably as a rather inefficient steel plant until the market develops to the point at which it can support it. However, it must be taken in certain sized steps, but we are looking at steps in approximately two million tons. The Japanese build their plants in increments of 20 million tons. So this factor enters into it and does affect the cost per ton, particularly in the resource industries.

**Senator Stanbury:** But the Japanese do not sell all that steel domestically?

**Mr. Chapman:** No, not by any means.

**Senator Stanbury:** That is precisely my point. Surely, economies of scale are not based upon domestic markets in worldwide industries such as steel.

**Mr. Chapman:** Very much so, senator, because transportation is the next factor that enters into it.

**Senator Stanbury:** Japan is a long way off.

**Mr. Chapman:** Yes, but water transportation is very cheap in comparison to other types.

**Senator Stanbury:** So, it is a question of whether we are going to Europe across water or 200 miles across the border.

**Mr. Chapman:** That is right, and it would probably cost more to ship a product 200 miles by truck than to bring that same product from Japan to the West Coast by boat.

**Senator Stanbury:** We discussed a few moments ago the inequities of tariffs, and I am shocked by that. I do not see why we should allow a product to enter Canada at a tariff of 7 per cent and have to give away 22 per cent to send it out. I do not understand how our people could have allowed that situation to come about.

Assuming that Japan is in the same competitive position in the world as Canada and is able to sell over those tariff barriers, and further assuming that there are factors such as transportation, as I am sure there are, working the other way, why are we not able to capture our share of the world market in those areas where we have expertise and industrial leadership?

**Mr. Chapman:** I think perhaps the question of capital investment becomes the next factor.

**The Chairman:** What about R&D?

**Mr. Chapman:** To some extent, R&D enters into it, yes.

**The Chairman:** We can look to Finland as an example. It produces 50 per cent of the icebreakers in the world.

**Mr. Chapman:** I recall seeing that statement, but I am in no position to comment on it.

**Mr. Bata:** If two are being built and they are building one, that constitutes 50 per cent.

**The Chairman:** I think the whole question boils down to the assumption that we have had to make with respect to Canadian attitudes towards R&D and innovation. I recall, for instance, during our hearings in 1968 and 1969 that a number of industries, specifically the chemical industry, gave as their approach to R&D that they would spend money on development and innovation, and so forth, when their respective industries were profitable. In other words, they viewed R&D as a consumption activity, while the manufacturers in other countries, as we are aware, view R&D as a source of profitability, as a means of developing markets. If that type of passive attitude towards R&D is widespread in Canada, it is little wonder that we are not an innovative country.

**Dr. Allenby:** I do not recall those statements, Mr. Chairman, as I did not attend the earlier sessions. However, I believe the point being made was that we are concerned about long-term profitability. We keep coming back to the environment for innovation. Long-term profitability is essential for investment, because that is the way investment makes sense. Investment does not make sense if long-term profitability is in doubt. In those countries where innovation has been successful, long-term profitability is a part of the total system in which innovation is inserted.

The chemical industry, traditionally, has been wide open to imports because of low tariffs. Again, we run up against the economies of scale problem. In the case of R&D, there is such a thing as a critical mass. Below it, you are wasting your money. To attain it you must have a certain minimum market, and if our market in Canada is only 10 per cent of that in the U.S., there will be many areas in which we cannot attain the critical mass required to conduct effective research. In those areas, we had better go out and buy it, which is what we do.



**Senator Stanbury:** Mr. Chairman, my concern in this regard probably stems from experiences which I have had in various countries on at least three or four continents where I have talked with local political people and our own trade people, and people in industry in those countries. Rarely have I found that those people have experienced any kind of intensive selling effort on the part of Canadian industry.

As I mentioned yesterday, one of our former trade ministers said to me one day, "You know, we do not export in Canada; we permit others to import from us." That, I confess, has been the experience I have had as I have visited countries in South America, the Middle East, Europe, and so forth. They have not seen a Canadian!

I am concerned when I hear so much emphasis being put on the matter of economies of scale. There are other countries in the world with smaller populations than ours which have, in specialty areas, much better export records than ours.

There is another side to this, in terms of small industry, which I should like to talk about; but particularly in terms of large industries where efficiency exists and where capital is available to get into R&D programs, and so forth, is there not some way in which we can take advantage of that to take a larger portion of the world markets?

**Dr. Allenby:** Of course, the history of development in this country has been to develop our natural resources. Canada is rich in natural resources. Beyond that, you have to create a manufacturing infrastructure, and that takes time. I am sure everyone is familiar with Petrosar, which involves a government agency and Union Carbide in an attempt to create the next step in the infrastructure, to provide the next stage of raw material, ethylene, at an economic scale. That scale today is one billion pounds, whereas 10 years ago it was probably 200 million.

We are spread very broadly in our manufacturing abilities. You keep referring to countries which have been successful in concentrating their efforts, and that is great. We have not followed that course in this country, for a variety of reasons. We are now attempting to produce infrastructures which end up with manufactured products—atomic reactors and aircraft being typical examples. Perhaps part of our problem is that we are too broadly based in our manufacturing base. We do not make watches. The Swiss concentrated on watches because it suited their economy. Sweden concentrated on steel and machinery because of its power resources.

**Senator Stanbury:** So, we have built those infrastructures in the resource industries because they were there.

**Dr. Allenby:** We are in the process of building them. It takes a great deal of capital.

**Senator Buckwold:** Another factor, I think, is the fact that we are in the shadow of the world's greatest industrial nation. I think that has had a negative effect on the development of a manufacturing sector. I am not now referring to foreign ownership, but simply the fact that we are next door to this industrial giant.

**The Chairman:** Do you have further questions on this section of the brief, Senator Godfrey?

**Senator Godfrey:** I did, Mr. Chairman, but I think we can move along.

**The Chairman:** Are there further questions on this section?

**Senator Buckwold:** Mr. Chairman, perhaps this might be the appropriate time to move into the field of productivity.

In talking about a science policy for Canada, it seems to me that the science of management, which was referred to earlier, and the science of proper industrial procedures which, in fact, result in better productivity, have to be important elements in any program aimed at improving the industrial future in this country. I am particularly interested in the area of productivity because at one time I was a member of what was known as the National Productivity Council, which was established by Mr. Diefenbaker.

**The Chairman:** I do not know how you came to be a member of that council!

**Senator Buckwold:** I was appointed a member because of the goodwill of a fellow Saskatchewan citizen from Prince Albert!

At that time, the country was going through the same feeling of a lack of competitive position, as is the case today. The government saw fit to appoint a National Productivity Council whose responsibility it was to stimulate an interest, an awareness, in the importance of productivity and, in fact, to develop programs that would improve that whole situation.

I think that to a degree it was reasonably effective. I believe a Mr. Young from Atlas Steel was the chairman. That eventually evolved into the Economic Council of Canada. The Economic Council moved into that field with a productivity branch, which has now lost whatever impact it had.

The question I wanted to raise with you this morning is whether you feel there would be room, or the necessity for the re-introduction of a national program for improved productivity along the lines of the former National Productivity Council, or some other setup. I have come to the conclusion that we need a major national effort in this regard involving the cooperation of management, labour and industry, and I would like to get your comments on it.

**Mr. Chapman:** I am not aware of what happened in the early sixties as that was before my time in industry. At that time, I think the whole of Canadian industry was really just getting into the management tools that allowed it to look at productivity and to assess what could be done. Industrial engineering, so-called, was coming into being at that time, and I think it has progressed a long way since. I think the companies have the management tools to look at productivity. I am not sure that they can always take the results that they find and implement them because of all of the other factors that have been discussed, such as the economies of scale, capital investment, and so forth. I really have no opinion as to whether this would be successful or not.

**Senator Buckwold:** Of course, productivity involves much more than management skills. The following headline appeared in the *Globe and Mail* of August 6: "Lower productivity is costing Canada jobs." The article following discusses productivity in Canada in relation to other countries.

**Mr. Hughes:** I am not an economist, but I can say that I think industry, and certainly CMA, speaking for industry, would agree with you that productivity is the single most

important issue facing the competitiveness of the manufacturing sector. We are comforted by the knowledge that it is a major study of the government, through the Department of Industry, Trade and Commerce, and that the association itself is fairly intensively studying the subject right now and hopes before the end of the year to have some concrete proposals to offer. I cannot say more than that, other than to share your concern that productivity is the No. 1 issue facing the manufacturing sector.

**Senator Buckwold:** It is my hope that this committee will review the productivity aspect of the policy for the future, and perhaps may even come back with a recommendation that the federal government should provide much more leadership in this field than we have been giving recently.

**Senator Godfrey:** Would you agree with that, Mr. Chapman? In this brief you say to the government: "Keep your sticky fingers out of it; we know our own business."

**Mr. Chapman:** Well, I think that is a very general attitude and I still support that attitude. I am in a little bit of a quandary as to what you would expect this to do for us. I think the factors of union power and the influences of unions that we are getting into, the very narrow mindedness of some of these people, are probably some of the factors we in industry see as being in some degree limiting on productivity. Some industries are much worse than others.

**Senator Buckwold:** The Productivity Council was made up of representatives of industry, labour and government, and I think one of the major challenges was to have management and labour acknowledge the problem and perhaps come to some better arrangements than we are able to work out now.

**Mr. Chapman:** Well, I certainly think that if they don't accept the fact that the problem exists, and that jobs are only going to be available as long as profits are available, and if they do not recognize this fact and try to do something about it in their own structures, then there is no question but that there is going to be a major problem and it will cause a lot of trouble.

**Mr. Bata:** Mr. Chairman, I think we might be going in the wrong direction in the discussion. I think productivity is very pertinent to research and development, and productivity is really composed of three components. The first one is to know how to do the work; secondly, you have to have the proper tools; and the third one is that you have to have the will to do the work. All these three aspects are going into the productivity of our industry which may or may not be competitive in some areas. There is no single factor which affects the will to work and people cite all kinds of things, such as wages, welfare and unemployment insurance. These may or may not be applicable. When it comes to tools to do the job it is a question of investment, and the investment climate may or may not be adequately attractive. The government perhaps would have a role in this area as well. The last component is the skill—the ability and the know-how to do this work. This may be partially educational, but to some extent it is a question of research and development. Do we know how to do this job better? Can we do it more cheaply? Are there short-cuts? Can we reduce our operating costs, can we improve product quality, can we eliminate rejects, can we develop better machinery? These are areas where scientific research does enter the picture. This is what you may have been driving

at originally, and I fully agree with you, but we should not lose sight of the goal, and this is perhaps the gist of our presentation, that you cannot take research and development out of context and use it alone as a tool. No matter how much whipping we are doing, the research laboratory is not going to change the economic climate for doing business; and the funds for doing research ultimately have to come from earnings. If these potential earnings are not there, no amount of incentive programs, or anything of that nature, will enhance the quality of the research done. We used to say that you can perhaps push a thread at the very first moment through the eye of a needle and it will go through, but you cannot continue to do that. Eventually you have to pull; and this pulling effect is the one created by the investment opportunity, the business climate and the possibility for obtaining earnings. This is what our whole brief is aiming at. That is what has to be enhanced.

**Senator Buckwold:** I think you have given a very good summary there. I think a very important factor is the will to work, and what the National Productivity Council integrated really was a public awareness program of the importance of the very things that count.

**The Chairman:** I think we can note that discussion, and I think it will be very useful when we come to prepare our report.

I have three comments on that section. You say on page 7 that you view with considerable impatience statements still coming from responsible sources that Canada should allocate 2.5 per cent of its GNP to R&D. You are probably referring to those targets partly because we were among the first to suggest them. But your statement, as it reads, is only part of what we said, because you will no doubt remember that we suggested that this 2.5 per cent target should be a target, provided that we would have worthwhile projects to spend the money on; and we went on to say also that if we could not attain these targets by 1980, or more or less towards the end of that decade, we might be in trouble in terms of innovation and invention and markets. I just wanted to make that correction, because I think you might have less impatience if you had added the conditions that we put in our report.

Then in the statement made by the Canadian Chamber of Commerce quoted on that page, again it seems to me that there is some confusion there. Again there is a reference to these R&D/GNP ratios, but the context of that quotation seems to be that we suggested these percentages only for science, because it says here, "Therefore doubling Canada's contribution to world knowledge will not have the substantial effect looked for, particularly since intrinsic to the suggestion is the representation from some sources that the increased effort should mostly be in the development of fundamental new knowledge."

It certainly was our intention to include not only fundamental research. We were very much criticized for allegedly trying to downgrade basic research in our report, and we certainly included in this target not only the research but also the development leading to innovation. This is another correction I would like to make.

And then the final question, and perhaps it could come later, but have you made—or perhaps I should say that you have apparently made a study of the influences, limitations and complications that Canadian industry faces and which come from government. I wonder if there has been any study by industry of the various factors which account for its weak research and development performance and



financing in Canada, quite apart from government factors which would be purely industrial and which would have their origin in industry—in other words, industry looking at itself in the mirror instead of looking at the government.

**Dr. Allenby:** Well, Mr. Chairman, I think when you speak of industry, you find it is a very broad context.

**The Chairman:** But we have three very broad associations.

**Dr. Allenby:** We find, for example, a completely different approach in R&D between an industry where product turnover is very high. Such an industry would put most of its R&D into new product development rather than protecting old products because that is the way the business is structured. Other industries will put a good deal of effort into supporting existing business and improving productivity because that is the kind of industry they are in. Other industries will do nothing because they are not technology intensive and you cannot try to find universal truths for industry.

**The Chairman:** But you could go at it sector by sector. I know some companies which are relatively profitable which do not do any kind of research, and I think it is a very short-sighted view that they take. It seems to me that you could take various sectors, that is, that your associations could take various sectors, and see if the management of those industries are sufficiently aware of the potential profitability of R&D, and see whether they could do more or less. Do you rely on the government to make those studies?

**Dr. Allenby:** Well, Mr. Chairman, perhaps I should answer the question rather than indicating difficulties. So far as I know, the CMA has not conducted such a study.

**Mr. Bata:** Such studies have been made in the United States by the American Management Association, and there is a great deal of similarity—I would almost say identity—of problems in how to run a business in the United States and in this country. So the techniques of methods, management, allocating funds for advertising, R&D, engineering, etcetera, are very similar in both countries. So I would say that we Canadians rely more on American information along those lines, and there is very little justification, that I can see, for making specific studies only from the business management point of view.

**The Chairman:** That certainly does not correspond to my knowledge of the situation, because first of all our two economies are quite different and we have had just a few studies like the ones produced by Professor Globberman, which we quoted in volume 2 and which said that the situation in Canada was quite different, for a number of reasons, from that of the United States. In all the studies that we have been able to consult from the United States they have shown that there was a very high degree of correlation between R&D and profitability, and the only study that Professor Globberman has produced for Canada is that there is very little correlation between R&D and profitability in Canada.

**Mr. Bata:** There is also a study by Dr. Godbout. But that perhaps is another Canadian study by a government official.

**The Chairman:** Then there was a study by Mr. Wilson on the "cold climate", and this was a study of government limitations and not on industry itself.

**Mr. Chapman:** May I make a comment on this, Mr. Chairman? Here I am not speaking as a researcher but as a citizen, and what I see transpiring, it seems to me, is that the level of sophistication of management ties in very closely with the use of R&D because Canadian industry in general is much younger than that in many other countries. Canadian industry in general is much younger than in many other countries, and I think there is probably a better correlation there, that as management skills and sophistication improve, this situation will improve with it. I hate to call it a climate, but as long as the climate for investment is there, I think these skills will develop.

I think maybe there are two things that influence it. One is the fact that to a great extent we in Canadian resource-base industries which tend, because of volume, to have a very low percentage base of R&D, and on the other side a very high percentage of service industries, which also tend to have a rather low base. We do not have that middle manufacturing type of industry that would bring the overall average up. I may be completely off base, but this is the feeling I get, sitting back listening to the same topic being discussed in many, many places. I am not sure that there is any one solution. We discussed this among ourselves a great deal last night. Because of the various sectors within Canada that there are, I really cannot see that there is one solution.

**The Chairman:** But we should find some solutions. This is one of the main worries of this committee, as you very well know. We have, during our first inquiry, detected that one of the weak sectors of the whole field of research and development in Canada was not in universities, and was not in the field of basic research; the weak sector was industry. Each time we start to discuss this problem industry tells us that it is the fault of the government; very often the government people tell us that it is the fault of industry. I wish that at some stage we could get at the various possible sources of weakness and be able, at the end, to produce, not one solution—as you say, there is no one solution—but there might be different solutions we could find. I think that only a detailed study of the industrial situation could produce that kind of information. I think we can take care of the limitations and influences produced by the government, but I do not think that we have here the knowledge that you have of industry itself.

**Dr. Gordon H. Segall, Chairman, Canadian Chemical Producers Association; R&D Committee, Canadian Industries Limited:** I think it is difficult for industry to look at itself in a collective sense, because industry only consists of individual firms, yet activities carried out in the individual firms do amount to looking at itself in all firms large enough to have a continuing development effort—development effort in the sense of seeking opportunities for new business, either for existing products or services, or for new products and services. I think what we see as the result of this kind of activity is a low level of R&D based on an overall business assessment of the return likely to be achieved in new ventures. I think this is a fact of Canadian business life. We have discussed some of the reasons for it and some of the symptoms of it, which are an overall low level of R&D in industry as compared with some other advanced countries.

I think there is another factor that has been hinted at in many presentations, and we should face it. That is that operating in this climate does create people whose experience has been rather negative, in the sense that the work they do, which is very professional and of high calibre,

very rarely results in dynamic research development commercial activity, which happens in other markets, particularly to the south of us. I think the lack of involvement in the total development process by Canadian management does create a lack of experience, which is a definite hindrance. It means we will not be as skilful in seeing opportunities and exploiting them as we might otherwise be. Again I think this is a result of the Canadian business environment, and it will be difficult to create experiences for management that would make them more effective other than being in a better environment. I think it is worth at least facing this issue, which has often been raised. One of the reasons is that Canadian management just is not sufficiently imaginative, aggressive and so on to do things that would otherwise be feasible in our environment. I think this is a result, not a cause.

**Senator Godfrey:** I do not quite understand. Do you think a lot of it is because of the type of entrepreneurial and innovative experience applied by head office in these days?

**Dr. Segall:** No, sir. Most of us here who are members of multi-national corporations address ourselves to the opportunities we see first in the Canadian market. Speaking for our company, I do not think that is a matter of policy; I think that is simply a reflection of the fact that the multi-national will do the bulk of its innovative R&D in its largest market, because it will have the largest resources there, the largest pay-off, the fastest rate of commercialization, the fastest pay-back and so on. We do not see that kind of thing in the Canadian activity, such as is seen in some other parts of the world, although not because of the technology; I think we receive far more technology than we could ever use.

**Senator Stanbury:** Part of the environment you speak of is the fact that many of the multi-national organizations which are represented here also control the export policy in such a way that, generally speaking—I know there are exceptions—the Canadian element is not able to overcome its economy of scale problems because it is not permitted to go out.

**Mr. Bata:** That is a generalization. I do not think it is necessarily the case. We have found that in many cases the fact that one is a member of a national organization, and hence has an export opportunity because one has a ready-made network through which one can export, one has a potential location for exporting, and as long as operating costs are reasonable the company prefers to export from those various locations in order to satisfy worldwide demands. It is very hard for me to conclude either way, whether if one is an international or multi-national corporation one is limited or enhanced in this respect. If I had to make a choice, I would rather say that in our specific case the fact that we are a multi-national company means that our export position is enhanced, and our business figures prove this point.

**Senator Stanbury:** I can give you some very specific examples where it has worked to the contrary. I also know of good examples where multi-national companies have indeed done a great deal of exporting. I got back from one of my marketing trips and called three different representatives of a particular industry in Canada and advised them of a particular market, a very large market, that was available to them; I got calls back in each case from their representatives in New York or Chicago, in each case telling me, "We don't export from Canada." I said, "But

you can't get this market except through Canada." In other words, those people wanted to deal through the United States in the present political circumstances; their response was, "Sorry, but we don't export through Canada." I do not disagree with your disagreement with my generality. I just say there are those cases, and I am afraid there are enough of them that our economy of scale situation is affected by them.

I did not really want to make a speech; I just wanted to throw something at you. If, on the other hand, we can find some means of encouraging the multi-nationals to develop particular products which are indigenous—I appreciate this is a natural thing for them to try to do, but I am not sure that it is done to the extent that it could be done—to develop particular product lines in Canada, which then are given the benefit of the world distribution facilities of the multi-nationals, that is the place where we can get the benefit of it. What I am asking is: Are your associations attempting to persuade our industry to work along in this direction?

**The Chairman:** I believe Mr. Garton would like to make a comment.

**Mr. Garton:** I should like to speak to that last comment and the question of R&D in Canada and innovation. I think we have a good example in the pharmaceutical industry of what has happened. If there is no protection for the innovator, then he will not innovate unless he gets a climate where there is protection. You just made a point about our associations working with our multi-nationals and with our corporations in Canada, saying, "In the development of a new product, if you could shift some emphasis and resources into Montreal or Toronto, or out West, to any one of our firms, for the research development inventiveness, the innovation for the product, we could work on markets for you and use the distribution system." In our industry we are just about to cease doing innovation and development in Canada because we have no protection.

**The Chairman:** You do not mean tariff protection.

**Mr. Garton:** No, patent protection. Our industry is the only one in which this happens, under Bill C-102. I think in relation to all of industry, besides the business of technology and whether management has the expertise or the bent to do innovation,—some industries do and some don't—it is the climate, the appearance; it must be profitable, otherwise it will not be done. The climate in the country must appear to be profitable in order to have this innovation done. To me, innovation in most industries—I am not talking about service industries—is just basic to the expansion and growth, not only of our exports, but for our own market and the profitability of our industry. This, I think, is the thrust of our submission. It ties in exactly with what you said about why the multi-nationals are not too interested, in our industry anyway, in developing new products in Canada.

**Senator Lang:** You say you have no patent protection.

**Mr. Garton:** No.

**Senator Godfrey:** You have got all the patent protection you need in the United States, whether the invention is in Canada or in the United States.

**Mr. Garton:** Yes, but we are talking about the development of innovation in Canada.



**Senator Godfrey:** But if you have a development and innovation in Canada you are doing it for your American parent as well as for the Canadian subsidiary.

**Mr. Garton:** Yes.

**Senator Godfrey:** You get the benefit of patent protection in the United States; you are not developing the same product; you are not overlapping in your development or your R&D in the States and here.

**Mr. Garton:** No, but the product that is produced without patent protection in Canada would become an American product and you would then have to import it.

**Senator Lang:** By "no patent protection" do you mean that you are subject to compulsory licensing provisions?

**Mr. Garton:** That is right.

**Senator Lang:** How many compulsory licences have you granted since that amendment went through?

**Mr. Garton:** Very many.

**Mr. R. E. Everson, Director of Research, Pharmaceutical Manufacturers Association of Canada:** It was 121 at the last count.

**Mr. Guy Beauchemin, Executive Vice-President, Pharmaceutical Manufacturers Association of Canada:** It was 149 at June 29, 1976. They are licences of the products that are successful, that have made the market. All the R&D has been done by somebody else; the market has been reached, it has been set up, and then in comes the other company and produces it.

**Senator Lang:** Certainly you must get some fees for the licences.

**Mr. Garton:** Four per cent.

**Senator Lang:** What would you normally expect?

**Mr. Garton:** It should possibly be in the neighbourhood of 18 per cent, 10 per cent, 12 per cent; it varies considerably.

**Mr. Beauchemin:** In the United Kingdom, where there is similar legislation, the royalties granted are of the order of 23 to 28 per cent. It varies.

**Senator Lang:** How is that set? What is the procedure for setting the rate?

**Mr. Garton:** On profitability.

**Senator Lang:** The market is so limited that it produces 4 per cent.

**Mr. Garton:** No. The 4 per cent was set by the Commissioner, and that was it, by the government.

**Senator Lang:** But the government does not take a figure out of the air. You certainly make representations to the Commissioner on rates and so on. What has been the experience?

**Mr. Garton:** The experience is that the company, the original licence holder, obtains in many cases 4 per cent. In many cases it may obtain one per cent, because it is for a joint venture with four companies involved, but it remains at 4 per cent royalty.

**Senator Lang:** That is not really what I am getting at. Obviously the patent commissioner must listen to evidence as to what the percentage should be, and obviously you must make representations with respect to that amount, and you must also use analogies such as you have mentioned here this morning.

**Mr. Garton:** Yes.

**Senator Lang:** I find the discrepancies to which you refer hardly credible, unless the Commissioner of Patents is devoted to some sort of ideology with which I am not familiar.

**Mr. Beauchemin:** When the legislation was adopted in 1969, one of the provisions of the act was that "the commissioner shall set the royalty, taking into consideration the research leading to the development of the invention and such other factors as may be prescribed from time to time." We had great hopes about the "such other factors," but we have never been able to persuade government or the Department of Consumer and Corporate Affairs to indicate what these other considerations should be. So the commissioner just set 4 per cent as his basic, subject to some further directives, which he never got, and he was stuck with 4 per cent. In the new revamping of the Patent Act, in which all industries, not only the pharmaceutical industry, will be subject to the act, the 4 per cent is enshrined in the act itself, at least for the first six months of the licence during the period of registration. We cannot live with that.

**Senator Godfrey:** There have always been compulsory licensing provisions. What is the difference in the act?

**Mr. Beauchemin:** The previous provisions were enacted in 1923, at the same time as the British legislation was enacted. These were only for imports. In 1969 the law was extended to allow for compulsory licensing of imports so that anyone, whether in pharmaceutical manufacturing or not, could import from Hong Kong, Italy, Hungary, enter the Canadian market in violation of the Canadian owner of the patent and then undercut him. Of course, he had no development or marketing costs; he did not even have to have scientific information in Canada.

**Senator Godfrey:** You say 149 compulsory licences.

**Mr. Beauchemin:** Yes.

**Senator Godfrey:** How many of those were patents that originated in Canada?

**Mr. Beauchemin:** I do not know the number.

**Senator Godfrey:** Well, that is very important; the figure of 149 is not very relevant. We want to know the number of compulsory licences which have been issued as a result of patents which were issued because of research and development by the pharmaceutical industry in Canada.

**Mr. Beauchemin:** It is very difficult to pinpoint the exact time at which a particular invention took place.

**Senator Godfrey:** I agree with that statement completely.

**The Chairman:** I hope that if you have that information you will provide it to us.

**Senator Godfrey:** Because you must list the name of the inventor in order to get this, so would you please tell us in how many cases the inventor was Canadian?

**Dr. Stuart:** The only further comment I would make on the subject of pharmaceutical research, to enlarge it a trifle, is that what happened historically is the following: Up until the early 1950s only two companies, one of which I represent, carried out research in Canada. They were the Ayerst Company and Charles E. Frosst. That was during the 1950s. Then the other multinationals, Ayerst being part of a multinational, began to do research in Canada. It was first in clinical research then further back looking towards the individual products. So I think the partial answer to your question is that before 1950 there would be very few pharmaceutical patents in Canada, because there were very few people doing research that would lead to patents. During the 1950s research began to develop and the other company I represent, namely Merck, started research in Canada.

**Senator Godfrey:** Could you explain why they started then, when they had not done it before?

**Dr. Stuart:** Why Merck started?

**Senator Godfrey:** Yes?

**Dr. Stuart:** First of all, in order to get clinical acceptance of the product you must carry out clinical research in Canada, because if the doctor is not acquainted with the development of the product, your chances of selling it are not very good. Even if you buy a product abroad it still must be done and that applies to every country in the world. The other part began because people felt in the 1950s that this was a kind of situation in which they could get together a team and the climate would be right to look for that. The industry was growing in Canada and the research began to grow with it. The incentive of the government which came along in 1960 probably put some impetus into pieces of that pharmaceutical research. So there was growth up to the late 1960s, but since then there has been a falling off. Companies have closed their research laboratories, for example, and there now are perhaps four or five people doing research towards products. Everyone is still doing clinical research because it must be done in order to sell the products. So after 1960, in the late 60s, we began to see patents for products which will be ultimately used for the treatment of disease. Some of these come from our laboratories, some from other laboratories. I do not know of any of those products which are being sold in Canada that appeared during that era. From the point the patent is obtained to getting the whole thing developed through research, et cetera, involves possibly a ten-year lag, seven, eight, up to fifteen years, depending on the product. We have a couple of products, which I hope will hit the Canadian market within the next year and a half, which came from our own laboratories in Montreal. I want them produced in Canada. I know, for example, that we are going to have to produce outside the United States. In general we produce some of our production outside the United States and some within the United States. So now I am in the competitive position and climate, but every other sophisticated country, such as the European Community, Japan, et cetera, where we operate, involves competition. If you look at the many disincentives in the Canadian climate to deal just with the research side of the patent situation, this is what will probably happen. Laboratories that are flourishing and paying off will probably continue, but they probably will not grow. Even if the industry generally expands, the chances are that the production people will be outbid by often a better deal in some other country. I do not know which country that would be, but I think this is the kind of situation we must face if we are to

get a piece of that action in the marketing, or a piece of research, because the multinationals can put research in any country they wish. If they are going to spend their money, they are likely to spend it where they feel the whole picture is conducive to what they want to do than in a place where there appear to be restrictions. Although these restrictions apply to the Canadian market, they do not apply to what you might sell abroad. However, I think it is not unreasonable that people might put their eggs where they think the whole picture, including the home market for that particular company, will be more conducive.

**The Chairman:** I am sure that the committee will wish to consider these points which, in my opinion, have a great deal of validity. However, I see that we have less than an hour now and we still have to discuss at least two very important subjects, the make-or-buy policy and incentives for R&D to industry. We will move to page 19 of the brief.

**Senator Godfrey:** On page 19 of your brief you say:

Industry invests funds in proportion to the expectation of improved profitability.

I would say that I could not agree with that more and I expect that is why they would do it. It continues:

Amongst those government policies and actions that are required to improve the economic climate are:

1. Taxation levels for industry which are competitive with those in other countries with whom we trade.

We have had some discussion with respect to that already, so I do not need to go into that again, although I think Mr. Drury made a statement in this regard, that the government did reduce its tax, to which we have already referred, the corporate rate of tax and made other incentives for fast write-offs and so on.

When Mr. Drury appeared before this committee on February 18, 1976 he said:

You may recollect, senator, that a couple of years ago there was a significant reduction in the corporate tax rate to allow Canadian corporations to compete rather more effectively with their counterparts south of the border, as a consequence of tax changes, particularly the DISC program, introduced down there. The hope was that with this particular tax incentive there would be available more money for development and research within Canadian corporations remaining in corporate hands.

The tax review committee which looked at the consequences of this tax reduction—how the funds remaining in the hands of the corporations were used—was—I will not say disappointed, but I was certainly disappointed, to discover that virtually none of the increased revenues remaining in their hands were put into the research field. These figures that the Chairman has quoted demonstrate this. Despite a significant incentive tax reduction, Canadian industry chose not to employ, to allocate, these additional resources in any significant way to research and development. You can hardly blame the government for this.

I am not necessarily blaming industry, either; I want to make that perfectly clear. However, have you any figures, statistics or information that would dispute that claim?

**Mr. Chapman:** I do not believe so, sir; I am not aware of any. In my opinion the timing is one factor that works



against all of us. That is, at the time when this tax change was made we were in a very high inflationary period. The other aspects which tend to eat up money within business probably were some of the major reasons for that not occurring as people thought it might.

**Dr. Allenby:** I am not terribly surprised at the end result, because, after all, we have said with respect to research and development that it is a long-term commitment. Whenever you expand your budget you must hire people and add buildings. You do not wish to be in the position of having to close down wings and labs if things do not work out right in the future. Every balance between corporate resources and R&D takes time to change. In the meantime we had this national recession which interfered with the long-term commitment in R&D investment. We are now talking about the period subsequent to the change in taxation.

**Senator Godfrey:** The tax change, as you will recall, was part of the 1972 budget, and then an election intervened. Mr. Turner, the then Minister of Finance, agreed with your view completely. He wanted to make it a permanent long-range commitment to enable business to plan ahead, whereas the Opposition wanted to make it short term. As you will recall, that fight ended in a saw-off whereby 60 people signing a petition could reopen the subject. The main argument Mr. Turner made during the debate on the budget was that it had to be a long-term commitment.

**Mr. Chapman:** I believe some companies also made long-term commitments. Speaking on behalf of my own company, since 1970 our budget for research has increased by a factor of five. My company is probably an example of a company that has moved ahead in this direction. We have now hit a plateau where we probably will not have any further expansion for probably two or three years. There is a level of activity in research that should be maintained, and we gauge ours by the total tons produced by the company. We try to maintain approximately 20 people per million ingot tons produced. Until we get an increase in productivity, or an expansion in productivity, we will remain at our present plateau. We are not limiting our staff by saying that that is the number, but it seems that that type of thing probably takes place.

**The Chairman:** So, you have a target.

**Mr. Chapman:** We have a target, certainly, but it fluctuates around that target based on the particular economic conditions of the time. I might add, 1976 was the first year that we have not had a major expansion of budget within our own company. Certainly, I hope that will be short term. I cannot speak for too many of the other companies represented this morning, but I can speak for one or two small companies of which I am very aware. I think they are very much in the same position in that they will allocate more funds for research when they get out of the other problems created by the present climate. I think perhaps some were scared off by the Anti-Inflation Board guidelines which came out classifying research in the same category as advertising, that being as a restricted expense. That has now been changed, and I am sure that we will see an increase in research over the next two or three years.

**Senator Godfrey:** You carry out research because it is good business to do so. Research has certainly paid off for your company and your industry generally.

**Mr. Chapman:** Yes, certainly.

**Senator Godfrey:** At page 21 of the brief you discuss tax incentives. First of all, you say that the concept of IRDIA should be retained, and you have updated us on your approach to that in your opening statement. You go on to say:

All incentives should be managed through a tax credit approach—i.e., allow a tax deduction equivalent to X per cent of *current* R&D expenses while retaining the present 100 percent business expense write-off.

Mr. Drury had some comments to make on that. As you will recall, during the period 1962 to 1966 there was a tax incentive approach which was on the basis of a tax deduction of 150 per cent. On February 18, Mr. Drury said:

The tax incentive scheme we had earlier has not been a marked success, and that is the reason for it being repealed. Perhaps there are other forms of tax incentives, and if this committee has any ideas, we would be glad to hear them.

So, they did try a tax incentive program for that four-year period. According to Mr. Drury, it was not a marked success. That program was based upon a base period and a reward for increased expenditures in R&D.

**Mr. Chapman:** You are now talking about the period 1962-66?

**Senator Godfrey:** Yes.

**Mr. Chapman:** There was no base period. There was a base year rather than a five-year base period.

**Senator Godfrey:** Yes, and there were rewards by way of tax incentives for any increase in expenditures over the base year.

**Dr. Segall:** That program lumped capital and current expenditures. I know in our company we had spent \$4 million on a new research establishment in 1962 and we could claim nothing under the tax credit program for the next five years. The reason, of course, was that it was a capital item.

**Senator Godfrey:** I think the tax rate at that time was probably in the area of 50 per cent. Assuming it was 50 per cent, the result of the 150 per cent tax deduction approach was that the company, in effect, paid 25 per cent of the cost of increased research and development. What you are proposing now amounts to the same thing in dollars. The present rate is 40 per cent, and you are advocating a tax credit of 35 per cent. Therefore, it comes out to the same amount that was given under the earlier incentive program.

What you are saying now, however, is that the government should allow this credit on all research and development, not simply on any increase.

Why should that inspire people to carry out more research and development when you, in your own brief, admit that you do research when you consider it profitable and that it should be left to industry, and so forth?

**Mr. Chapman:** I think you have to look at two things. First of all, I believe—and I think perhaps the numbers would probably support this belief—that research and development did grow at its greatest rate in Canada during that 1960-66 period. I think the expansion in research was probably far greater during that period than at any other time in our history. As one of the other gentlemen mentioned, his company built a lab during that period of time.

We did exactly the same thing within our own company. That period was really the ground for, and the start of, research on a large scale in Canada. Prior to that, there was not a great deal of research that was being carried out in Canada. I think that program started it moving.

I do not think people really understand that we have to have something that we can count on for 10 years or more in order to make the types of investments in equipment and personnel required to carry out and expand research.

When the government brought in the five-year average base, we had to look at annual growth more than anything else, which reduced research. The dollars people were spending on research now became the greater portion of a true dollar. What we are trying to say now is that there has to be some incentive for business to choose research over some other expenditure, if they are absolutely equal, as they are today, without any IRDIA at all—and you have to remember that at the time this brief was written, IRDIA was then in the throes of disappearing; it had been announced that it was to be cancelled with no effective date. So that in reading the brief, the light changes, depending on the time frame that you relate the brief to.

**Senator Godfrey:** We have heard one statement from the minister and something else from your association and the Pharmaceutical Manufacturers Association. What we are really interested in getting is a broad picture. Have you got any figures of the research carried out in Canada during the period 1962-66? Those figures would assist the committee in determining whether or not the minister was correct in his statement.

**The Chairman:** We published those figures in our first volume.

**Senator Godfrey:** Do you recall what those figures indicated, Mr. Chairman?

**The Chairman:** No, I do not.

**Dr. Stuart:** We are not suggesting that the government spend more money on research. We are putting this up in lieu of such programs as IRDIA, and other forms of incentive, except the make-or-buy program, which we believe has a place. We are suggesting that the Canadian economy will get more mileage out of supporting research across the board than it will in the government trying to select or agree on certain specific projects.

As Dr. Allenby pointed out earlier, a great deal of research is carried out because it is vital in terms of productivity and competitiveness. We feel that global support of research is going to do more for Canada in terms of employment, competitiveness, and so forth, than a policy which attempts to isolate projects in the way previous programs have.

Other important factors in any research program are time limits and financial limits. If my company is allocating \$1 million for a research program and the government is putting up \$250,000, or whatever it will work out to on this scale, and I know I am going to have that, together with the inflationary effects, for the next 10 years, then I can sit down and plan a program that, I guarantee you, will result in a product.

**Senator Godfrey:** But surely what we want to do is to provide an incentive, and what we want to find out is that if we recommend what you ask for, which is, in effect, subsidization of all research carried out in Canada

amounting to 75 per cent of the cost, will that be simply looked upon as a hand-out to industry which will improve its profitability or will it in fact make it more attractive for more research to be carried out?

The steel companies are going to carry out research no matter what happens, simply on the basis that research has paid off for them. The pharmaceutical industry, whether the research is carried out in Canada or the United States, is going to carry on. It is a highly intensive research industry which could not exist without research. The question of whether that research is carried out in Canada or the United States is another subject.

The minister has made the statement that even when an incentive was provided, it did not result in increased research. What I want to know, and what this committee would like to know, is how we can be assured that a tax incentive such as you are requesting will bring about the desired results.

**Mr. Chapman:** To answer your first question as to statistics, senator, I have some Xeroxed pages from a report of Statistics Canada. These pages quote the figures in respect of total expenditures in R&D by performers, and they indicate that in the fiscal year 1965-66, the expenditure was \$75.5 million; in 1974-75, the expenditure was \$167.9 million. Those figures represent industry's portion of the cost of R&D.

**The Chairman:** This is the portion financed by industry?

**Mr. Chapman:** That is correct, and the figures show that expenditures have doubled between 1965 and 1974. I do not have all of the report with me. I hope I am not quoting this out of context. In any event, I do feel that those incentives did have an effect.

**Senator Godfrey:** I believe 1965 was the last year for the tax concession.

**Mr. Chapman:** I believe it was replaced in the 1966-67 fiscal year.

**Dr. Allenby:** Mr. Chairman, I should like to get back to a couple of universal truths.

**The Chairman:** You are going to tie them into incentives.

**Dr. Allenby:** I do not believe that the object is to support research in the abstract. Research as an activity which has no industrial end result is wasted. The end result could be the furtherance of knowledge, and that is something the universities should be involved in. We are after improved productivity, improved fiscal stability for the Canadian economy. Because Canada is a technology-based society, the government some years back declared that it is going to be a national purpose to support technology. Under those circumstances, we do not believe fiscal support on the part of the government should attempt to discriminate on the basis of market or market forces. We feel it should be in the hands of industry to decide whether it is in their best interests to increase research, because in so doing they will increase the competitiveness of their business and perhaps help it to expand and create new products and things of this sort. The tax system is then free of dominant decisions made by the outside—the decisions now are put back into the hands of industry through the tax system. If the results after four years are disappointing, it is just another example of what we keep saying, that research is a



long-term activity and after four years you could not expect to see a great change in the balance of the application of resources that the government has at its disposal. When we talk about a tax system, we talk about it essentially as being the correct way to get the decision-making process back into the hands of industry, which is worried about profitability; and, secondly, it must be long term, and both the tax system and IRDIA turned out to be short term, in the sense that we are using the term.

**The Chairman:** I have two quick questions which I do not want to forget. First of all, you have a proposal here, and you are representing three major Canadian associations. To what extent does this proposal represent the views of the membership? Has there been any consultation? I think this is quite important. We wanted to hear from industry, and I would like to know if this represents the consensus of your membership.

**Dr. Allenby:** In the case of the CMA, the draft of our brief went out to each of the 60 members of the R&D committee, with the invitation to reply to what we had said. We got replies in some instances and we incorporated them to the extent that they made sense in the text, so I think I can say; therefore, that we went through the process of determining whether this represents a consensus. Copies also went to the members of the Board of the CMA, and we have the chairman of the other groups, the CCC and the CCPA who went through the same process.

**Dr. Segall:** The CCPA, the Canadian Chemical Producers Association, is not listed in the document but, as mentioned by our chairman, it was endorsed subsequently by the board of the Canadian Chemical Producers Association and in the same way as the CMA canvassed its membership with a draft. This was done through the CCPA R&D committee membership, and through this process it was endorsed by the membership to the board.

**Mr. Stuart:** As far as the Chamber is concerned, we did exactly the same thing. But to emphasize this particular section, we have a submission that we are going to talk to Mr. Drury about very soon, on this very subject, which is also endorsed by the Chamber of Commerce.

**Mr. Bata:** The Canadian Research Management Association is not an industry-connected body; it is a professional body and this recommendation has been circulated to the membership, feed-back obtained, corrections made, and the submission is endorsed by the managing board.

**The Chairman:** I think it is useful for us as a committee to know more about this process of consultation.

I have a second brief question. Have you been consulted by Mr. Sharwood in the process of preparing this report on incentives to industry?

**Dr. Allenby:** We were aware of Mr. Sharwood's activities. He and I conversed on the telephone a number of times. Our draft of the brief was not in a proper form so that he could use any of our ideas. He subsequently received a copy, but I believe that he had drafts of his own submission prior to that.

**The Chairman:** Prior to your consultation?

**Dr. Allenby:** No, prior to the actual preparation of his report.

**The Chairman:** But he knew before what would be in this brief.

**Dr. Allenby:** We sent him a copy. But I cannot be precise now whether the draft was in proper form or not.

**Mr. Chapman:** I think the comment really would be that there was no detailed discussion with him at any point. There was certainly some correspondence or discussion with him, but I don't think they got to the depth that we might like to have seen happen before he submitted his report and, as chairman of the committee, at the present time I really have no inside knowledge or any knowledge at all of what is contained in his report or what the rationalization behind it was.

**The Chairman:** I was not asking for that; I was just asking if you had been consulted before he prepared his report.

Were you consulted, Mr. Garton?

**Mr. Garton:** On this particular brief?

**The Chairman:** Yes.

**Mr. Garton:** No, we were not consulted because our brief covers a fairly narrow area.

**The Chairman:** Not about this brief, but about the Sharwood report.

**Mr. Garton:** No.

**The Chairman:** I will just go back to one question for Senator Stanbury.

**Senator Stanbury:** I am really concerned, because we seem to be getting into a conflict here, and I think I can best point it up by reading a little bit from your brief, at the top of page 11, where you say:

The lack of national objectives is nowhere more clearly demonstrated than in the Canadian attitude towards basic scientific research. We have scattered our talents,

And so on. We have just now said that what we want is a global approach to incentives for research, that we do not want to have national objectives to be regarded as important in these decisions. Perhaps that is an overstatement. What I am saying is that the incentives that you are suggesting are ones which are not pinpointed. In other words, you are objecting to the old system which brought the government's judgment or some element of the government's judgment on to the question of whether this particular type of research was one that should be encouraged. It seems to me that what you are looking at—and I am just asking for comments on this—is really a two-pronged system, one which may well be the global type for companies which are not involved in national objective industries, perhaps; but, for instance, yesterday we heard a great deal about the amount—the almost frustrating volume—of work that has to be done in some “national objective” industries, like the whole energy field and so on, and it has to be done either by government or by government and industry working hand in hand and, undoubtedly, with the government paying for a good deal of what industry does or, at any rate, giving them support. So it seems to me, especially in areas where you have a national objective and where you are trying to zero in on some things which we must do, you still need the zeroed-in incentives, but there is a much more general competitive manufacturing field where perhaps the suggestion that you have made is the one that would work best.

**Mr. Chapman:** I think, if you take the two in combination, the universal type incentive as an over-all picture, where government and industry objectives are similar, is probably adequate to cover it. The "make or buy" policy, we feel, is the other tool that has to cover these other alternate areas. One of the things that we found lacking in the present system was that when a crisis like the energy crisis came up, it did not fit any of the present programs, and now you have to scuttle around and spend a year developing something specifically on energy. We feel that this system would be far more flexible and allow you to make that move as soon as it is declared that this is a problem.

**Senator Godfrey:** Carrying on, then, with your specific proposals, I must say that I personally in the past have rather favoured the tax incentive field because by allowing income tax concessions you help successful, rather than the ones that go down the drain. But you seem to want it both ways here. First by the tax credit system, because even though it is unsuccessful, although you do confine it to certain companies by the million dollars, the government by its tax system would still be in effect making grants to unsuccessful enterprises by reason of a tax credit system rather than by tax deduction.

**Mr. Chapman:** That is true. I think the limitation of a million dollars is certainly one. The other one being the Canadian-owned companies factor. I believe there is also a lot of support for a time limit on this. I do not think anybody would say that this should carry on *ad infinitum* because it does exactly what you say—it creates cripples in industry, and I do not think we need those.

**Senator Godfrey:** I realize there is no easy answer to either one, and I do not think you can generalize, because the Carter Commission report came out very strongly against using the tax structure, and yet if you go to Collingwood, where I ski and which was designated as a depressed area under the tax system, and see the industries that have just blossomed there as a result of that, there certainly is room in the tax system to encourage industry. I am just pointing out that in this limited way you are getting away from one of the main attractions of the tax incentive system, but I understand it is only for small companies. But this idea to initiate a tax-free holiday for innovative processes or innovative products developed and manufactured in Canada for the first five years of a profitable operation—in other words, you carry on and the government is financing it, in effect and in other words, and it only costs you 25 per cent for research and development, and you produce something which is successful, and then you say there should be no income tax paid on the profits of that for five years.

**Mr. Chapman:** I think this is aiming at another aspect of that whole process, which is the capital investment side which has to be made following the research process. That is the big hurdle that we see in a lot of industries today. The product is successfully developed and then the manufacturing becomes a stumbling block.

**Senator Godfrey:** That is one of the purposes of accelerated depreciation. The 50 per cent write-off and the 40 per cent reduction rate in income tax was designed to improve the cash flow of companies.

**Mr. Chapman:** But, again, very high interest rates enter into this as a major factor.

**Senator Godfrey:** But you do say, and I agree with you, that this would present considerable difficulties. And we had the point raised as to how do you determine who invents something and at what point is it an innovative product? I can see horrendous difficulties arising out of this. Later you say that this would greatly simplify procedures. How do you reconcile those two statements?

**Mr. Hughes:** Well, senator, when we said "simplify" we were not thinking of paragraphs 3 and 4. We are very much alive to the administrative problems that paragraphs 3 and 4 would create. The tax committee looked at them and shook their heads and said, "Gee, we will have to sit down and work that one out." We did not have time to do that, but we do agree that there are many problems to be dealt with there.

**Senator Godfrey:** I just wanted to make that clear.

**Mr. Chapman:** I think that if you were to talk to some accountants they would really shake their heads at that one; they would throw up their hands at the utter chaos that that would create.

**Mr. Hughes:** I would mention parenthetically, Mr. Chairman, that paragraphs 3 and 4 were favoured and inserted here as an additional step because it is an attempt to reward successful innovative products. It is a direct mechanism for rewarding successful innovation. It is for that reason that it commends itself to the R&D community, although the taxation community can see the problems of implementing it.

**The Chairman:** Would the provision of special loans be helpful? I know it would certainly be much less of an incentive than this tax holiday, but, at least, if there is a scarcity of funds it might be helpful.

**Mr. Chapman:** I think that for a small company that would be one way, but I think the large companies might be in a different situation. I am not sure how favourably that might be looked on politically.

**The Chairman:** You don't need any money.

**Mr. Chapman:** Oh, I am not saying that, not by any means, but I think the phrase "corporate rip-off" would very quickly come to the surface again in those circumstances.

**Senator Stanbury:** The Industrial and Business Development Bank might well be a factor here.

**Senator Godfrey:** That is a perfect example. Again I come to page 23, where you talk about research and development being not just for innovation but also for productivity at more competitive cost, which surely must make so much sense to any industry. Surely that makes so much sense for any industry, yet the industry wants again to be heavily subsidized through the taxes in order to do something they should do on their own, in any event.

**Mr. Bata:** When you say "on their own", let me add that if you are running a business you have got to do several things. You can pay it out as dividends to the shareholders; that gets the heaviest tax load; probably for consumption when it gets into the shareholders' hands that dollar is worth something like 12 cents on the original dollar. The next opportunity is to re-invest that money in capital facilities. That dollar costs a full after-tax dollar, because this is coming from taxable earnings. You can invest the same money in engineering, and if you do that this is a



pre-tax dollar, because it went to engineering. If it is a large company it might be a 50-cent dollar, whatever the tax rate is. However, if you want to encourage these dollars being invested in R&D rather than in engineering, for cost improvement, it has to have some additional incentive; it has to be an even cheaper dollar. The best business is to do that, and you make a choice between paying out the dividends, putting it into new capital facilities, into providing funds for engineering, cost improvements or research and development. This is what we are seeking.

**Senator Godfrey:** I do not understand. You say you require more incentives for R&D even if it makes business sense? I do not follow.

**Mr. Bata:** If you want to make a choice whether the investment is to go into R&D or into something else, it should be more attractive to put that money into R&D than into anything else.

**Senator Godfrey:** You put R&D first and then you put it into expansion. You people are the steel companies.

**Mr. Chapman:** I think what Dr. Bata is really saying is that if you are doing these other things that he is talking about there is a known end point. When you start into research the end point may be failure, and that failure is as costly as a success, so that you have, I think, to look at it on the basis of a shared thing for engineering or plant expansion or anything else gives you one result. Research is not a known result. Therefore companies are a lot more skeptical of providing funds, on that basis. There is an opposing view here, but it is really what happens; you not only have to make good business sense, but you have to show the dollars and cents on a page.

**Senator Godfrey:** I agree.

**Mr. Chapman:** If a company had probably a 50 per cent success rate in research it would be reasonably good, so that the 50 per cent that are failures always keep getting washed under the table, nobody bothers looking at what money you spent there.

**Senator Godfrey:** When you say 50 per cent, that would be pretty high, would it not?

**Mr. Chapman:** It depends on the industry.

**Senator Godfrey:** I suppose it does.

**Mr. Chapman:** It depends on whether you are looking at new product research or what I tend to call the development side of it, which is more increasing productivity and improving products, that type of thing. Depending on which one of those areas you are in, it can be a lot higher than that or an awful lot lower.

**Mr. Bata:** May I point out that "Dr." Bata is my wife. I am "Mr." Bata.

**The Chairman:** You have raised a sensitive area, and everybody is speaking at the same time.

**Dr. Allenby:** I do not believe we are speaking to the point you made. I think the basic point is: Is it the national intent to support R&D, or is it the national intent to support R&D which would otherwise not be done? If the government believes that support of technology is important to the national purpose, that is a principle. Support of technology that would otherwise not be done will ultimately actually create a long-term benefit, because I think if

technology costs less we will be doing more of it; but that will be long term. Through PAIT, IRAP and the special programs there is very heavy emphasis on the development of technology which otherwise would not be done, because they are oriented around single, highly specific objectives. I think the national goal must to strengthen the total technology infrastructure, as I understand the purpose, which there fore argues for a broad, global—I think that is the term we use—incentive program rather than aiming at specifics, which is an ad hoc approach to the national problem of increasing the total R&D capability.

**Mr. Hughes:** The issue is how particular or universal should the program be. We have considered this quite lengthily, and to put it as crisply as I can I think we would say the best public policy in that area would be one which promoted R&D, period. In doing so you will get all the other fall-out that you might otherwise want, such as a particular R&D in a particular industry, if you were wise enough to choose it as a winner to start with. You would be getting the other benefits of getting the R&D which would not otherwise be done if you could devise a scheme to identify such research projects.

We are saying that when you look at the past history you find there was a tax incentive with a base period. Perhaps it did not work so well. There were then the alphabet programs that zeroed in on particular species of R&D; perhaps they did not work so well. We are putting up another alternative, which is: Why do you try to zero in on particular types of R&D? Why do you want to try to promote R&D which would otherwise not be done? We believe that both of those approaches have in the past not been as effective as perhaps everyone would have liked, and there have always been problems of identifying either the sure-fire winner which you should invest in or the research which would not otherwise have been done. It is very difficult to identify both those things. Therefore, we have concluded that as a matter of public policy it probably would be better to have an incentive scheme which was general, all kinds of R&D, because you get all fall-out from it.

**The Chairman:** In the form of a tax credit?

**Mr. Hughes:** Yes, that is a particular incentive.

**Senator Godfrey:** We are talking about incentives here and we want to keep to that. I must say, I did get a chuckle when I read this in your brief on page 24:

In addition the base year concept should be eliminated, thus removing financial incentive inequities associated with an unavoidable static level of effort.

In plain English, what you mean is that you want incentives, you want these grants, these tax concessions, whether or not they result in an increase in R&D or not.

**Mr. Hughes:** Yes.

**Dr. Ron S. Stuart, Chairman, R&D Committee, Canadian Chamber of Commerce; Merck Frosst Laboratories:** I think you have to have a balance. We have talked about a number of disincentives. What we have been referring to is a clear disincentive to doing research. We have tried to strike some kind of balance between incentives and disincentives, and I think if you view it in that context you will perhaps see a clearer picture.

**The Chairman:** Could we now move to the subject of "make or buy"?

**Senator Godfrey:** I do not have any particular question on that.

**The Chairman:** How did it work, and how is it working so far as industry is concerned?

**Mr. Chapman:** I can only make the comment which I made when I spoke in the same program as you did, Mr. Chairman. We see it as having worked in very specific areas, such as transportation, communications and what I guess I would call the data collection area; it is pseudo-scientific related. This is mainly because it is the area where government has been, and is, the largest customer. It appears to have worked fairly well.

In the other areas where government is not the major customer and the objectives of industry and government do not line up, we do not see that it has really done too much, particularly in the larger industries. In the smaller industries, to some extent, yes. The unsolicited proposal has been one aspect of it which perhaps hasn't had a chance, to this point, to be exploited as much as it could be, and this is one of the reasons why we suggest that that particular part of it very definitely be kept; we see that as being the tool, other than the universal program, that government can use where specific support would provide an incentive and would provide encouragement, whatever you want to call it, to get a specific piece of work done.

I do not know whether we can be super-critical of the fact that in the other areas it has not worked. If we are going to be critical of it, we have to be critical from the point of view that it is not the make-or-buy policy; it is the objectives of the department that are not what we would like to see, and if those objectives were realigned so that industry and government were shooting at the same target, then "make or buy" has everything that is needed in that area.

**The Chairman:** We were told, for instance by the Department of Agriculture, that they contract out and they have used the "make or buy" policy very little, certainly not enough, to my satisfaction. However, we were told that industry does not seem to be interested.

**Mr. Chapman:** I do not know whether there is anyone here who can speak for the agricultural industry.

**The Chairman:** I chose this only as one example, that some of the government people complained that industry has not reacted positively enough to the potential that is there, and I understand that there is a problem in this regard.

**Mr. Chapman:** "Make or buy" has been around for two or three years now.

**The Chairman:** A full three years.

**Mr. Chapman:** It is now getting into its third year, but we are talking about research in a very long-term context. If you expect miracles to happen in three years, they will not; it will take longer. If you look at the R&D bulletin issued each month, you will see that it is expanding constantly, with more unsolicited proposals. In my opinion, the government and department managers are getting to the point of using it more. Maybe if there was more incentive for them to get this work out into industry that probably would assist. However, I really do not see any short-term solution.

**The Chairman:** I understand that this is just the beginning of that policy and it may, perhaps, achieve more results in the future if it is continued, which I am sure it will be. However, at this time you do not have any particular complaint as to the application of the policy; you are just airing grievances.

**Dr. Allenby:** We should not lose sight of the fact that it is strictly a matter of comparable missions. If there is an industry with a mission that matches a government department, such as communications or transportation in particular, there are many contracts going out and this is not new. It has been going on for many years. It did not take the "make or buy" policy to do that. If you look at the chemical industry, it is difficult to see any point at which we can interface with a government department. I am rather encouraged by the efforts of the Research Council to marshal large programs. I believe one they are working on is in the food industry, in which food technology, which might come out of the industry, could be oriented around some specific need of, perhaps, the Department of Agriculture. In my opinion, a fair amount of complaining in those areas in which there is not an obvious correspondence of missions, at least on the surface, would be the secret to expanding this beyond the two areas in which it is working, in my opinion, quite effectively.

**The Chairman:** You mentioned the whole area of energy R&D a moment ago and you had a complaint, I believe?

**Mr. Chapman:** Yes; my complaint really is that when the whole energy crisis came along there was no obvious program. It did not fit PAIT or any of the existing programs, and until funding and so on was developed by some other mechanism there just was not any way. I happen to know that there will be, through "make or buy", coming out in the very near future one of the first packages on energy. In my opinion, that is the mechanism that should be used, rather than attempting to develop new policies. If they have some type of interim funding situation by which this can be tackled immediately, that would certainly give it the impetus it needs.

Another comment in the same area is that the unsolicited proposal, although it does not change department policy, sometimes makes departments look at policy. When someone submits an unsolicited proposal the mechanisms of the Department of Supply and Services force them to look at it and decide whether it is in their mandate. In that manner it may be a means of getting something before them in a little better manner, with a faster reaction than you might get by other means, because it is wider than an individual person or department, so there must be wider reaction to that. In my opinion, that will add to the whole situation.

**The Chairman:** Do you believe that most of your membership are aware of these programs?

**Mr. Chapman:** I think the companies that are involved with the various associations here, sir, are certainly much more aware of all the programs than the small, general, run-of-the-mill companies. This is one of the problems of the small industries; they do not tend to attend the meetings and so on of these organizations. Hence they may not have the same insight into policies that we have. I do not know how we would change that; I have no idea in the world how to change it. One of the things that is helping to change it is the larger companies, because they have the expertise when through their own organizations it is well



known that this exists. However, they tend to help the smaller companies, which are their customers, in this mechanism by telling them that they have someone who knows about the problem and sending him out to discuss it with them. On a number of occasions, I have personally gone out and talked to our customers and told them certain ways by which they should go about things. Maybe it is the accountants who must be educated as to what is available in all this, but I am not sure that even that works. However, to get through what is available in R&D as incentives, programs or anything else on a broad, universal basis, I do not know what more we could do than what is happening right now. It certainly is not reaching everyone and I do not know how to cure it.

**Senator Stanbury:** The reason I am returning to this point is that when I asked whether we needed a two-way program, your answer, Mr. Chapman, was that probably the "make or buy" program was the other side of it. I realize as you are speaking and referring to the narrow objectives of the particular ministries and so on that there is still a big gap. I am worried about your very strong concern with respect to scattering our talents and saying in few areas have we concentrated enough effort to build a significant reputation for Canada and so on. We constantly hear people say that there must be an industrial strategy for Canada; we cannot do everything, but must move in the areas in which we have developed expertise, or we will be lost in the shuffle.

You take your global approach to incentives, which will be fine because it will help the industry which is not in one of the specialized fields to build an infrastructure of R&D and encourage the academic community and the scientific community, thus obtaining the best benefit out of those people and stopping the brain drain, et cetera. We can think of a long scenario in that respect.

The "make or buy" program can certainly in very limited fields, such as energy and transportation in which the government itself is active, play the role we have been discussing, and I think it is a matter of giving it longer time and greater exposure to industry, and so on, which will work. However, there is still, surely, a gap if the government or the people of Canada—let us not put it that way—maybe it is industry that really makes the decision, but is it wise for Canada not to scatter its talents and find some priorities and objectives in an attempt to build a reputation for Canada in some areas? Then, surely, there should also be a program to encourage R&D in those identified areas.

**Mr. Chapman:** I think the problem with that is that the program in general is short-term. We cannot build the expertise through some specific program that will continue for ten or twenty years. That must happen through need of the industries and this is how they are created now. The institution of a program that will encourage it may get it started, but it will not sustain it and it is the sustained effort that we need. When you start into an area of expertise—and you can pick anyone you want—in the first generation you get to a certain level; in the second generation you probably double or triple the expertise in the first. This is the type of situation with which we are faced. I do not see how this will be accomplished by aiming these programs at specifics, because it is not going to last. It will get it started and then something else has to take over.

**Senator Stanbury:** What you are saying is that we should simply reinforce strengths rather than attempting

to create strengths. In other words, if we have strength building in an industry, we should support it.

**Mr. Chapman:** I think that if you are going to create a strength, you do so through the market pull that requires that to take place. Pushing on the rope is not going to help any.

**Dr. Allenby:** If I may make a further comment, may I draw your attention to the fact that the column is built around basic scientific research? It is very important to understand that there is an infrastructure in research also. In our own company, for every individual involved in basic research, which I define as developing an understanding of what is going on, a knowledge base versus development, for every man involved in that area, we have 10 involved in development; in the manufacturing, marketing and technical support area, we have 23.

You have to look at the implications of that. I talked earlier about the critical mass. It has been suggested that the critical mass for a basic study group is five scientists. Multiply that by 10 for development and you have 50; multiply that by 23, to carry it on to the next stage, and you are up to 115.

The question of critical mass in the total infrastructure is extremely important. Those five people involved at the basic research level have to have an infrastructure into which they can pump their findings. If that infrastructure does not exist, the research becomes undirected and will not produce results. The financial commitment is roughly the same.

**Senator Godfrey:** Regardless of the incentive given.

**Dr. Allenby:** These are facts of life that we cannot escape.

**The Chairman:** Before we break for lunch, I understand that the Sharwood Report has been completed and that it may or may not become public towards the end of September, at which time, of course, there will be some kind of governmental reaction to it.

We have received from our witnesses this morning two very important briefs, one of which has a larger content and impact. I realize there has been relatively little consultation between our witnesses and Mr. Sharwood.

Do you feel it would be a good thing to get your views more precisely and more systematically before the Minister of Industry, Trade and Commerce before that report is published?

**Mr. Hughes:** Copies of this submission have been or will be sent to the minister. Also, a copy has gone to Mr. Sharwood.

**The Chairman:** Have you requested a meeting with the minister?

**Mr. Hughes:** We intended to do that after meeting with this committee. We have also asked, as have many other people, for a copy of Mr. Sharwood's report.

**Senator Godfrey:** We can also make sure that a copy of these proceedings is forwarded to the minister, Mr. Chairman.

**The Chairman:** Of course.

**Dr. Allenby:** I might say that as part of the membership of the CMA R&D committee we have non-industrial

people. We have a fair representation from the government, specifically the Department of Industry, Trade and Commerce and MOSST. Peter Meyboom, for example, is a member of our committee, and he actually worked with us on this report. So, there has been input from government circles, although not specifically from Mr. Sharwood.

**The Chairman:** I hope you have found this meeting useful, gentlemen. As far as I am concerned, it has been a very useful meeting, and my views are certainly shared by my colleagues.

The committee adjourned.



APPENDIX "33"

JOINT SUBMISSION TO

THE SENATE SPECIAL COMMITTEE ON SCIENCE POLICY

BY

THE CANADIAN CHAMBER OF COMMERCE

THE CANADIAN MANUFACTURERS' ASSOCIATION

THE CANADIAN RESEARCH MANAGEMENT ASSOCIATION

MARCH, 1976.



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# I THE VALUE OF FUTURES RESEARCH

The groups sponsoring this submission note that in the Senator's report to the Senate on 10th July, 1975 one of the roles proposed for the Special Committee on Science Policy is to "make a survey of futures research programs being carried out within Government departments and agencies and see how the Institute (i.e., the Institute for Research on Public Policy, I.R.P.P.) will develop its new area of activities."

The Economic Council defines futures research as "the study and interpretation of the social, physical, technological and economic environment that may - or could exist, or that we would like to see or may help to shape in the years ahead, say beyond 10 years and into the next century." Our views are based on this definition which is consistent with the widely quoted "The Year 2000" by Kahn and Wiener.

It is impossible to predict the practical benefits of "futures research" and we believe it would be illusory, at least until we have more experience, to place high hopes on such studies, for these reasons:

1. Canadian society is and will continue to be shaped by a multitude of complex, interacting forces, many of which cannot be predicted with accuracy. Thus planning by industry and the research and development this requires will continue to depend on techniques such as demographic projection. The latter have been astoundingly accurate in predicting usage of large-volume commodities such as synthetic fibres and chlorine and can reflect quite well Canadian needs in housing, transportation, communications, food supply, energy, health,

etcetera. Technological forecasts combined with values analysis give valuable input into the decisions required to fulfill these needs in the most efficient manner. There is already considerable information of this kind; presumably the I.R.P.P. will use this as a basis for further research.

2. Many futurists now believe it is more meaningful to establish future goals and then try to identify the routes by which these objectives can be reached, working backward in time and downward in technological detail toward the present. The idea is not to prophesy the future but to "invent it", called by the futurists "normative forecasting". Unavoidably, normative forecasting must reach beyond the technological or economic, into the political and sociological environment, which is the second purpose mentioned in the futures research definition, viz. the society and government "we would like to see ... beyond 10 years and into the next century."

This leads to our second concern which can best be expressed by quoting from an article by David M. Kiefer:\*

"If economic forecasting is still an uncertain art and the techniques of technological forecasting are still in their infancy, sociological forecasting is largely the realm of intuition and guesswork alone - and grossly neglected, as well. It involves many uncertain and subjective value judgements. It must be based on theories of social behaviour that are largely unquantified and untried. Little is known about the cause-and-effect relationships affecting the social environment."

Furthermore:

\* "The Futures Business", Chem. & Eng. News, August 4, 1969.

"Many people involved in futures studies question whether the present generation should arrogantly assume a Machiavellian - if not Godlike - role by pressing its ambitions, goals, and values upon the future. Where would we be, they ask, if our forefathers had rigidly set their standards on today's environment and style of life? Who now has either the expertise or the authority to say how men should live 50 or 100 years from now? Does any elite group of sociologists, scientists, or planners, however self-assured they may appear, really know enough to do so? Scientists alone should not be solely responsible for the way a nation marshals its scientific resources. But if the future is indeed too important to be left to the planners or the futurists, how can other segments of society be brought democratically into the decision-making process? Questions such as these suggest a fundamental weakness in normative forecasting and long-range planning."

Because it is in the social environment where business must operate, pursuit by government of goals which could be contrary to what the environment would "prefer" to be could create a disaster for business trying to work in a society at conflict. We do not know how much futures research in Canada is occupied with "inventing" the future or how much research is planned but it seems to us that extraordinary caution is needed here.

Much of this section has been devoted to the long-term look at the future. Effective output from "Futures Research" should have shorter-term application as well. The data should provide the basis for: avoiding perpetuation of activities, departments or policies simply because they already exist; they should anticipate the time needed for flexible adjustment to unexpected changes that will surely occur; they should provide the base for nearer-term (five year) selection of objectives which governments as well as industry must follow if consistency is to be realized in developing policies and strategies and in managing departmental operations.



RECOMMENDATIONS

1. We recommend that careful monitoring of the future activities of the Institute for Research on Public Policy be given special attention. After a suitable period, (perhaps two years) there should be sufficient evidence that either the Institute is adding significantly to information already available or that their assignment is a wasteful duplication of effort.
2. The Institute for Research on Public Policy should seek outside input through continuing contacts with those groups which are active in the area of Futures Research.

## II LONG-RANGE PLANNING OF GOVERNMENT R. & D. ACTIVITIES

We endorse the recommendation that the Canadian Government and Parliament adopt an overall plan for science and technology (conducted by Government) based on longer-term projections and overall national R. & D. targets ... and "that by 1980 the approach be formalized in a framework of successive five-year plans.\*"

Assessment of the rationale for and the output from Government conducted R. & D. oriented towards national goals does not normally employ profitability as one of the criteria. This is a cleansing mechanism which industry cannot, at its peril, avoid. However, because Canada has insufficient resources for allocation to all possible objectives important to the nation, national priorities still have to be established and selections made. On the basis of intuitive judgement only, we can accept the four areas recently enumerated as being important to Canada with its special problems of large land masses bounded by two oceans and the Arctic seas, its small population concentrated in a few megalopoli and the remainder sparsely settled in the agricultural and other natural resource regions of our land. It is beyond the capability of those presenting this brief to comment with intelligence on what objectives should be selected in the prime interest areas. We are pleased to see initiative by the Government in organizing the creation of major programme objectives in those national priority areas (such as food processing) with technical activity to be undertaken by the three sectors - industry, university and government. We would hope that this could be conducted in a sufficiently organized fashion to ensure that the individual goals would be mutually supportive and free of self-perpetuation. If we are not to

\* A Science Policy for Canada - Volume 2, Recommendation P. 410.

squander the nation's limited resources, Canada must have a long-range plan for allocating these resources, reconciling conflicting views (further complicated by vested interests and political pressures) and the demand for resources in other needy areas competing for attention. It will not be an easy task. This is discussed in more detail elsewhere in this brief.

It is the strong belief of those involved in preparing this brief that the "Canadian Association of Parliamentarians, Scientists and Engineers" (CAPSE) proposed in Volume III of A Science Policy for Canada (and as yet unimplemented) could play a very key role here.

### III THE IMPORTANCE OF BALANCE IN THE NATIONAL R. & D. EFFORT VS. OTHER DEMANDS ON RESOURCES

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Given the degree of complexity in defining the proper level of total R. & D. effort to be organized around worthwhile goals (discussed in the previous section), we view with considerable impatience statements still coming from responsible sources that Canada should allocate 2.5% of its GNP to R. & D.. It is our opinion that this is an end result, a "grand total" in our national accounting system and that it is not a target. The implication that, because currently the percentage is at about half this level, we therefore have a "Mickey Mouse" technology development effort in industry, suggests a total misunderstanding of the purpose of new technology. We are in accord with an elaboration of these views contained in the 1975-76 Statement of Policy by the Canadian Chamber of Commerce: -

"Too much is made of comparisons of the level of Canada's research effort with that of other countries. Suggestions that, as one of our national goals, we should double or triple our R. & D./GNP ratio, in the expectation that this will give our economy a mighty stimulus, are ill-founded. Canada has attained its place among the top industrial nations of the world through effective development and exploitation of outside knowledge sources. The limits on Canada's growth have not been imposed by inferior technology, but by availability of economically sound investment opportunities. Therefore, doubling Canada's contribution to world knowledge will not have the substantial effect looked for, particularly since, intrinsic to the suggestion, is the representation from some sources that the increased effort should mostly be in the development of fundamental new knowledge.

Planned programmes which will produce a balanced effort in research and development/innovation should be our national objectives. Fundamental research is only one part in the total innovative process of developing and selling a viable product, or engineering and implementing a new process. Product or process oriented research and development are the larger parts of this process and certainly more demanding of funds.



Co-objectives of such programmes should be the creation of entrepreneurial and management skills, and most of all, the fostering of an economic climate in which all Canadian industry has the maximum opportunity to compete internally and internationally. Canada should be more concerned with the skills and technology that come with foreign investment rather than with the source of funds. The emphasis placed on technology benefits in reviewing foreign investments in the "Foreign Investment Review Act" is welcomed. Amassment of a technology base through encouragement of a strong innovative process, together with a policy which welcomes a selective importation of technology into Canada, will provide one step towards a solution of Canada's industrial woes."

Industrial expenditures on R. & D. are justified on the basis that the developments expected to ensue from the R. & D. effort can be practiced profitably within Canada for both domestic and export markets. Long-range growth of industrial research is little affected by temporary recessions in the country's economy. The amount of effort is based proposition by proposition on expected long-term opportunities in the marketplace. The effect of Government policies of recent years now seriously diminishes the prospect for profitable operations from innovation. Comments made by one of the participants in the original discussions held by the Senate Special Committee on Science Policy, are as valid today as they were then.\*

"The Canadian economic environment, reflecting Government policies, can be defined as follows: -

1. World leadership in reduction of tariffs without equitable tariff levels among other producing countries. This results in the acceptance of a role as an attractive area for large foreign imports from countries whose manufacturers enjoy relatively closed markets.
2. High rates of taxation and anti-combines legislation which hinders an effective response to the small-scale problem.

\* A Science Policy for Canada - Volume II, p. 539.  
Dr. H.F. Hoerig, (Vice-President - Research & Development)  
Du Pont of Canada Limited.

3. High taxes on building and construction materials which in combination with high construction labour rates and the scale factor result in investment cost per unit of capacity being the highest in the world.
4. The Canadian dollar remaining at par or for periods at a premium over the U.S. dollar, placing industry at a further disadvantage.

The conditions outlined have and will continue to exert a profound adverse influence on the scale of Canadian industrial research and development. It is axiomatic that industry adapts its operations to the environment in which it is required to operate. Under the terms of present national policy it is clear that industry will move toward simplification of its product lines, retaining for production in Canada only the larger-volume products least vulnerable to foreign competition across an open border. With reduced scope and no opportunity for significant diversification there can be no option but to adjust the R. & D. effort to a level consistent with diminished long-term opportunity. This process appears to be well under way and is a most regrettable but necessary response to the realities emerging from Government policy."

If Canada is to retain a viable manufacturing industry, Government must understand and redress the factors which are undermining the environment in which this industry must operate. Several of these factors have already been mentioned. There are others: -

1. If the Government decides to embark upon a programme to reduce industrial concentration in Canada, this would inevitably lead to a decline in industry's ability to undertake the risks in industrial research and development. The "critical mass" for R. & D. effectiveness is steadily rising and is an international trend which Canada cannot ignore. In addition the trend in the international marketplace is to utilize the efficiencies of scale and any attempt to lower concentration

and to fragment our industries in Canada would be an act of industrial suicide.

2. The increasing involvement of government in decisions which would be better taken by the private sector is a major deterrent to rational business planning. It creates not only a serious cost burden but also implies a governmental ability to make more intelligent decisions. Industry believes that the "intelligence" of the marketplace, well understood by industry, is more likely to be applied when decisions are made by the private sector.
3. There is an evident distrust of business by Government, particularly of "big" business and subsidiaries of multi-national enterprises. This distrust is not warranted. We believe industry's sense of social responsibility has been well demonstrated and in our opinion the sensitivity of the business world to the economic effects of continued heavy Government spending in non-productive areas is well founded.

#### IV TARGETS AND STRATEGIES FOR BASIC RESEARCH IN CANADA

The lack of national objectives is nowhere more clearly demonstrated than in the Canadian attitude towards basic scientific research. We have scattered our talents, and in few areas have we concentrated enough effort to build a significant reputation for Canada. More planned and balanced use of our resources is clearly indicated.

In the immediate post-war period, the National Research Council began a program aimed at building up basic research in the universities as well as in its own laboratories, and the importance and value of this decision cannot be questioned. At the same time, the provincial governments began an expansion of university facilities, once again a decision which has unquestioned merit. The error was that neither of these programmes was subject to the discipline of a long-range national strategy (unavailable anyway) and so the inevitable has happened. We now have in the combined research facilities in the universities and in government laboratories (particularly the Federal laboratories) more undirected basic research activity than we can justifiably fund if we are to achieve a balance in our National Research and Development effort.

A second aspect of basic research is that we have allowed ourselves to believe that goals and objectives cannot be set for basic research. While it is true that the end result cannot be predicted, the decision as to what areas of science should be emphasized is clearly ours. The important concept is that basic research can be directed towards fields where there is an obvious Canadian need. There are a number of such examples but we will illustrate our view-point by discussing health



care. Here again we find a lack of balance and objectives. Health care involves prophylaxis and medical treatment. Research in these areas has been largely directed towards medical treatment and has been supported by the Medical Research Council. There seems to have been difficulty in establishing the proper level of support. No research has been done on delivery of health care. Recently there has been greatly increased emphasis on environmental research and since this bears directly on health, it would seem that co-ordinated objectives are necessary. A health care bill of \$4 billion (1974-75) would seem to warrant more careful planning so that Canada makes the optimum research contribution to its health needs. Our common environmental problems with the United States would seem to allow us to place less emphasis on this problem than others concerned with the health of the nation.

This example illustrates our main point which is that basic research is a resource which, when directed towards fields of science that are relevant to our national problems such as health, education, communication and transportation, becomes a necessary activity. However, we must balance our resources in accordance with the needs in each area. The second point is that while the bulk of the basic research will be done in the universities, research institutes, teaching hospitals and the like, some basic research relating to specific programs and missions will have to be done in both government and industrial laboratories. Finally, there must be balance between basic research and applied research. Lack of national objectives has led us to a distorted situation where we are conducting more basic research than we can justify and it is foolhardy to continue on this road.

RECOMMENDATION

Clearly indicated is an orderly reduction of basic research unrelated to specific missions in government laboratories and as well, an equally orderly plan for university needs coupled with some level of orientation of university research activity towards national priorities. The percentage (within limits) of our effort devoted to basic research is far less important than the quality and direction of that research. And, as a corollary, the proportion of our national resources we devote to basic research is less important than the directions in which it is oriented. How else can we maximize benefits from finite resources?

V INDUSTRIAL INNOVATION

For the past thirty years, the Government of Canada has had various programmes of incentives designed to encourage industry to embark on research and development activities, or increase existing activities towards the improvement of products and processes. The Senate Special Committee on Science Policy has now recommended that R & D activities performed by the industrial sector be substantially increased so that by 1980 they represent a maximum of about 60% of the national R & D effort.

A company will undertake an R & D programme in response to problems, needs, opportunities, ideas, targets, and aspirations. The primary attention by all companies everywhere is to increase the productivity of labour and capital, to reduce costs and to solve problems associated with existing products and processes. To achieve this, a company will require a "mix" of activities, including "in-house" R & D, and the acquisition of technology from other areas such as government laboratories, universities and mergers with other companies. An enterprise will approach improved profitability through R & D in various ways and we believe the target of 60% is desirable only if it is justified by the business goals and climate of that time. This concept is more fully explained in Section VIII of this brief.

The Senate Committee on Science Policy has also recommended that secondary manufacturing industries be requested by the Minister of Industry, Trade & Commerce to organize task forces with proper labour

representation, to consider the problems of scale and specialization and to prepare a plan to improve the efficiency of the innovative capacity and the international competitiveness of individual firms through mergers and otherwise. The groups presenting this brief believe that the concept is essentially unworkable, both because it does not recognize the nature of the competitive activity between industries in their attempts to gain market share and also the privacy of the internal accounts which are related to "efficiency of innovative capacity and the international competitiveness of individual firms". In addition, as defined by current anti-combines legislation, various parts of the suggestion are illegal; the approach would almost certainly in some cases be subject to decisions by the Foreign Investment Review Agency; and, with respect to some export products, the companies would be in difficulty with foreign legislation; and one of the end results - the reduction in competition - is contrary to the philosophy of the Department of Consumer and Corporate Affairs. (Although we understand that mergers and rationalization agreements will be the subject of Stage II of the current review of competition policy.) Notwithstanding the foregoing, if these impediments could be removed, there would be certain industries (in particular the smaller ones where excessive fragmentation has occurred) and products where consolidation would improve costs and hence reduce prices. The groups presenting this brief believe that no organization of task forces is needed for this to be done. Companies in this category are fully aware of problems of scale and market fragmentation. The normal process by which consolidation (presently inhibited by legislation) occurs - through rationalization agreements or mergers - would be free to work in a free market environment.



## VI INNOVATION MANAGEMENT TRAINING

Through a series of events (which need not be recorded here) the R. & D. Committee of the Canadian Manufacturers' Association assumed responsibility for implementing recommendations 28 and 29, following the initiation by the Ministry of State for Science and Technology of a project with Queen's University to produce a suitable action plan for developing an innovation management training course. The R. & D. Committee of the CMA (through a Sub-Committee which had been assigned the task) defined the problem, developed an approach which it believed would attain the desired results and obtained the agreement of Dr. Blair Little, University of Western Ontario School of Business, to be responsible for the course. The course was to be completely independent and self-supporting. Agreement of this plan was reached with three other bodies - the R. & D. Committee of the Canadian Chamber of Commerce, the Canadian Research Management Association and Innovation Management Institute of Canada. For purposes of interfacing with Dr. Little and particularly to assist him in structuring a course to suit the needs of the clients and to provide suitable publicity, a Board has been created which is representative of the four groups. The course is programmed to be ready by May, 1976.

Dr. Little was strongly of the belief that if the course was worth-while and was filling a need, then a scholarship program would not be appropriate. (Recommendation 30). So at this time at least, the two-week course, with a fee of \$1,500.00 per attendee, is being structured as an independent business venture.

VII GOVERNMENT INDUSTRY WORKING GROUPS

Government Science policy is, or appears to be, set without adequate input from the innovation sector of the Canadian economy. The recommendations in Chapter 16 of "A Science Policy for Canada" suggest the use of science policy advisors and the Interdepartment Committee on Innovation as the means of providing MOSST with guidance on policy input to the Cabinet.

This approach would, in our opinion, present the Cabinet with an "inside" view as to the effect a policy would have on innovation but this would not necessarily represent a true evaluation as the policy advisors would not be in daily contact with the innovation process. We believe that input from people carrying out innovation and R & D should be made. The use of "outsiders" could be accomplished by using "working committees" made up of industrial and University scientific leaders who would work with the various departments and agencies to ensure that policy effects are evaluated before policies are issued.

The "working committees" should be made up of small groups from the field in question who would work with the department or agency before recommendations are made to the Cabinet which result in policy or legislation. This would ensure that the recommendations put forward had the best chance for success as the inputs would have come from the sources where policies apply rather than from a source simply created for the purpose of advising on policy. MOSST could provide the mechanism to bring about these "working committees" and the committee members could be drawn from

associations representing science in Canada, such as CMA, CRMA, CCC, IMIC, etc., and supplemented by individuals with expert knowledge in specific fields.

The "working" or "advisory" committee system already exists in Government/Industry groups such as NRC and EMR and produce excellent results. The extension of this format into other areas can produce equally good results and savings.

#### RECOMMENDATION

We therefore recommend that "Working Committees be used instead of Science Policy Advisors and the Interdepartmental Committee on Innovation to advise on Science Policy matters under the auspices of MOSST".

## VIII INCENTIVES FOR INDUSTRY TO INNOVATE

### A. Introduction

The Government has enunciated on many occasions its views about the importance of industrial innovation (i.e., new or improved technology and new or improved products)\* to the future of Canada and, on the basis of this conviction, have created a variety of financial incentive plans to stimulate this activity. We are asked to contribute to the discussions of this subject and to suggest ways whereby, as an agreed objective of national policy, industrial innovation can be further stimulated. It is in this context and for this purpose that we make the following comments.

### B. Economic Climate

The "pull" of the marketplace is the dominant factor influencing industrial innovation. Industry invests funds in proportion to the expectation of improved profitability. Consequently, anything which can contribute to a better economic climate for industry in Canada will positively influence industry's decision to invest in improving its innovative capacity. No financial incentive plan can offset the negative effect of an inhospitable business climate.

Amongst those government policies and actions that are required to improve the economic climate are: -

\* A more elaborate definition, with which we are in accord is contained in Science Council Report No. 15: "Applied to industrial activities, it usually means a conscious sequence of events, covering the *WHOLE PROCESS* of creating and offering goods or services that are either new or better or cheaper than those previously available".



1. Taxation levels for industry which are competitive with those in other countries with whom we trade.
2. Promotion of the purchase of Canadian goods and services within Canada unless otherwise justified.
3. Adoption of clearly defined policies for reasonable protection of high-productivity, innovative industry that is no less favourable than that accorded foreign-based competition in their home countries.
4. Enlargement of foreign markets accessible to the innovative products from Canadian industries through trade agreements, loan arrangements, and trade promotion activities.
5. Co-ordination of economic policies, for the encouragement of industrial innovation and productivity, amongst Federal departments and between, Federal, Provincial and regional governments.

C. Government Incentives for Industrial Innovation

We approach the question of financial incentives for industrial innovation in Canada with some diffidence. We have already said that an hospitable business climate is the dominant factor and that no incentive plan can offset the negative effect of an inhospitable climate. An hospitable business climate is, therefore, a "necessary" cause; whether it is a "sufficient" cause for stimulating industrial innovation is a moot point.

The Government has clearly stated that the further stimulation of industrial innovation is an objective of national policy. We are

asked how this can be done. If, as a matter of policy, the Government deems financial stimulation is in order, we suggest the replacement of all current alphabet programmes by a tax write-off mechanism. More explicitly:

From the viewpoint of most industries, tax benefits (at a proper level of inducement) offer the most desirable form of general incentive for the performance of R & D. The following tax incentives for the encouragement of R & D and innovation in industry are recommended to replace all current programmes:

1. Retain the concept of an IRDIA credit system for capital expenditures. Availability of modern research equipment can greatly increase the productivity of an industrial laboratory, and increasing such capital expenditures should be the goal of incentive programmes. Such expenditures should be incorporated as part of corporate tax reporting rather than continuing as a "grant". (See following paragraph.)
2. All incentives should be managed through a tax credit approach - i.e., allow a tax deduction equivalent to X% of current R & D expenses while retaining the present 100% business expense write-off. A rebate through a Federal granting process would be applied for a company in a loss position and would be restricted to Canadian-owned companies with an annual turnover below \$1,000,000.

The Make-or-Buy programme, in which Government arranges to purchase selected R & D requirements, should remain at the 100% level, as would be usual for any purchase of services.

3. Initiate a tax-free holiday for innovative products developed and manufactured in Canada, for the first five years of profitable operation. (We recognize that this and the following suggestion will present considerable difficulties in definition and administration. We would be happy to work with government officials to attempt to solve these problems.)
4. Allow income from patents, from licences or from technical assistance to be tax-free in the first five years and be taxed at one half of the corporation tax rate for an additional further five years. Individuals should receive the same treatment.
5. Support should be provided for other parts of the innovative process such as prototype construction and testing, process and product improvement and market exploration and initiation.

In comparison with existing incentives (including IRDIA), we believe the above recommendations would greatly simplify procedures in both government and industry, would provide greater stability in the investment climate and hence stimulate longer-range commitment to R & D, would enhance aggressive marketing for technological products and technology and, if the X% is high enough, would generate a higher level of investment in R & D in Canada.

Because these suggestions are substantially different from current approaches to financial incentives, we wish to expand on the basis for our suggestions:

Granted that R. & D. is a function which contributes to the profitability of an enterprise (and there is no other reason for its existence), too many narrow conceptions of its role are structured in the present incentive programmes. Businesses which conduct R. & D. are pragmatically sensitive to the options open to them as to how their technical effort should be deployed and at what level. Usually this results in the best choices - or they go out of business. Therefore, an enterprise (or a whole industry) will approach improved profitability through R. & D. in various ways. For one, the portion of its resources to be allocated to better corporate performance might be attuned to programs resulting in more competitive costs - either over a particularly low profit period, or even as a long-term approach necessitated by any kind of business it is in and the environment in which it is operating. It may decide, in addition, to hold R. & D. at a constant level and not embark on new product activity. For another, the enterprise might be one where product turnover is high and opportunity lies mainly in new products with only modest technical defence of the existing product line being undertaken. Both approaches to R. & D. are equally valid in promoting profit security - and, correspondingly, both are equally vital to the ongoing health of the national economy. We believe that Canadian business is healthily motivated by these practical concerns and that collectively one would find little disagreement amongst research managers from other countries about these principles.



*The general incentive which we are suggesting, should, then, be available to all companies irrespective of the "kind" of R & D they are carrying out.*

A general incentive for industrial innovation can probably be most efficiently administered through a tax credit approach, and in this regard we make these points:

- (i) A tax credit approach is readily compatible with the tax deduction of other corporate costs;
- (ii) It avoids the cumbersome procedures of grant applications; and
- (iii) Unlike discretionary grants administered by Orders-in-Council, it gives greater assurance of continuity which is necessary if plans to escalate or to make a long-range commitment of research and development are to be soundly based. We believe that the tax credit "X" should be something like 35% of R. & D. expenditures for the proposal to be effective. We suggest this figure because we estimate it would create no greater revenue loss than the government expenditures for existing incentive programs. In addition the base year concept should be eliminated, thus removing financial incentive inequities associated with an unavoidable static level of effort.

The principles which we have developed through this brief stress that the financial incentive program will be most effective when combined with implementation of policies and actions which will improve the economic climate.

D.     Make-or-Buy Policy

The Federal Government Make-or-Buy policy on research and development has the objective of a progressively larger portion of government-funded R. & D. being carried out by industry with the result of strengthening Canada's industrial capability and hence its competitive position. It can be used to build up selected sectors of industry which the Government considers important. We believe that this objective is particularly applicable in those areas where the missions of the government department match the missions of the industrial sector, such as in communications and transportation. In future, this may also be true in fields such as energy as increased emphasis is placed in these areas by national need and hence by government. On the other hand, it is unreasonable to expect that the Make-or-Buy policy can have a meaningful influence on those industries which do not have a commonality of interest with government missions.

To-date, the Make-or-Buy policy has not been particularly effective since most of the contracts have been small in magnitude (\$20,000-30,000), have been principally for services, studies for information gathering or surveys and have not been related to the development of technology. The majority of the contracts have been let to universities, service industry and individuals. As a result, there exists the under-lying danger of creating a long-term dependency on government contracts amongst the universities and small consulting firms. The recent trend is, however, encouraging with sizeable, technology-producing contracts being let in larger numbers to secondary industry. To make the Make-or-Buy policy more effective, it is necessary that more complete programmes be allocated to industry. This approach will require improved coordination of activities by government and industry on a continuing basis and as discussed in sections II and VII of this brief.

Initially, government priorities need to be identified and articulated to industry through briefings set out to: -

- (i) outline the long-range missions of the various government departments;
- (ii) describe the planned "in-house" activities;
- (iii) set out annual "contracting out" objectives;
- (iv) describe the type and quality of R. & D. to be contracted out.

Re-distribution of current funds for Federal missions involving R. & D. may be necessary depending on the specific national programmes that are identified.

It is further recommended that:

- The budget for contracting out to Canadian industry be specifically identified.
- The contracting out approach encompasses, as part of the planning process, contracts for detailed planning and feasibility studies and pilot projects related to the above missions.
- Incentives be provided for directors and managers of government departments and establishments to contract out.
- The terms and conditions of the contracts be such as to encourage industry to exploit the results in as short a period as feasible.
- A central government agency be given responsibility to ensure that the program plans and objectives are initiated and to audit progress and departmental performances.



## IX ESTABLISHMENT OF PARLIAMENTARY COMMITTEES ON SCIENCE AND TECHNOLOGY

In Canada, legislators insufficiently understand how science and technology function and how they inter-relate with the economic and social development of the country. On the other hand, scientists, engineers and technologists are not fully aware of the processes and milieu of parliament and government, and therefore of the manner in which their own ideas and developments can be best presented, understood and given serious consideration.

In order to help overcome the above problems, we recommend the establishment of parliamentary committees on Science and Technology, and, eventually, an Association of Parliamentarians, Scientists and Engineers.

1. Standing Committees of the Senate and House of Commons on Science and Technology.

We believe each House of Parliament should establish a Standing Committee on Science and Technology. They would have the responsibility for examining the policies, estimates and expenditures for the total government science and technology budget (currently spread over a variety of committees - defence, public works, miscellaneous). Such committees would:

- (a) force greater visibility into the government science and technology budget;
- (b) give greater public attention to science and technology and its role in the development of Canada;
- (c) help Canadian members of parliament develop a greater expertise in science and technology matters;
- (d) create a focus where public pressure (through the members of the

House of Commons) can be brought to bear on matters related to science and technology.

2. . Association of Parliamentarians, Scientists and Engineers.

According to the Senate Committee's recommendation\* this would be a relatively large association consisting of interested members of the House of Commons, the Senate and representatives from scientific and engineering associations and possibly other bodies. It would meet periodically when Parliament is in session for the purpose of presentations on and discussions of relevant scientific and technological subjects. Similar committees have been functioning in Great Britain and in Sweden for some time. No formal legislation is required for formation of such a committee, only the will on the part of the concerned organizations. We would support such a move.

\* A Science Policy for Canada, Vol. 3, Recommendation p. 749.

## APPENDIX "34"

Pharmaceutical Manufacturers Association of Canada  
Association Canadienne de l'Industrie du Médicament

Tel. (613) 236-9993      Telex 053-3122

W. M. Garton, President

January 29th, 1976.

Hon. M. Lamontagne,  
The Senate,  
Parliament Buildings,  
Room 575-F,  
Ottawa, Ontario.

Dear Senator:

Re: Science Policy

In reply to your kind invitation dated October 14, 1975, we are pleased to send you the comments of our Association relative to the modified terms of reference of the Canadian Senate Special Committee on Science Policy. You may remember that on the first of May 1974, we submitted a voluminous analysis of volume 3 of your report following our comments of October 20th, 1972 on your previous report.

We are attaching to this letter a copy of our previous recommendations which do not seem to have met with much favor since we have not been able to detect any sign of their implementation nor indeed do they appear to be reflected in your committee's report of July 10, 1975.

However, this time we intend to be brief and to the point.

The Canadian government's Science Policy, as it affects research in the pharmaceutical industry, appears to be relatively negative.

Our industry is the most research intensive manufacturing industry in Canada by most economic standards. The annual amount of research and development expenditures which were estimated to be \$1.7 million in 1957 have gradually increased to an estimated \$24 million in 1973. The pharmaceutical industry's research and development expenditures in the past ten years have amounted to over \$185 million, a not inconsiderable amount for an industry where annual sales in 1973 were in the order of \$400 million.

Hon. M. Lamontagne,  
January 29th, 1976,  
Page 2.

The pharmaceutical industry in Canada employed in 1973 more than 800 persons in research and development activities; of all Canadian industries, it employs one of the highest ratios of research and development scientists per thousand employees - 38 compared to 7 per thousand for industry in general.

In these days when many agencies are looking for government largesse, it is refreshing to note that research in the pharmaceutical industry is mostly self-financed. This industry has the highest ratio of company financed R & D expenditures to net sales of all Canadian industries. Only 3.5% of pharmaceutical R & D comes from government grants while all other industries average 15 per cent.

Another interesting point is that the pharmaceutical industry is first in Canada in terms of research expenditures as a percentage of sales - 6.8% relative to 1.5% as the average of all industries.

The pharmaceutical industry has a R & D to profits ratio of over 50% but the Canadian industry average is less than 10%.

One would think that with all these points in its favor, the pharmaceutical industry would be in excellent terms with the Canadian government and looking forward to continued productivity, innovation and prosperity.

Unfortunately, such is not the case.

From 1964 to 1969, the R & D scientists and engineers per thousand employees which was 42 in 1969 dropped to 38 in 1971 and the preliminary results from 1972 and 1973 indicate that the downward trend is continuing.

The main cause of this changed situation is the considerable disincentive to research in the pharmaceutical industry which exists since 1969 when the government modified the Patent Act to prevent, for all practical purposes, an innovative company from benefiting from the fruits of its research. This is achieved through the granting as a matter of right of compulsory licenses to use any patent issued on drugs in Canada. To understand the importance of this decision, it is useful to know that product patents are not available for drugs in Canada and that only process patents are issued; furthermore, the royalty granted on these compulsory licenses is extremely low - on the order of 4% of the licensee's selling price.



Hon. M. Lamontagne,  
January 29, 1976,  
Page 3.

The insecurity resulting from what was apparently a policy to depress this research intensive industry had a serious effect on the morale of our employees and a sobering effect on our shareholders. The fruits of research are now being gathered by those who did not participate in it and who can therefore sell their products at a price inconsistent with the up-keep of a research establishment.

This ability of imitative companies to undercut the price of pharmaceuticals has been encouraged by federal-provincial agreements on health care whereby the payment of pharmaceutical services to the socially assisted segments of the population are contingent upon the dispensing of the lowest cost product available.

In effect, the government is issuing licenses to expropriate the industrial and intellectual property rights of the research-oriented industry to reduce the cost of its social programs.

We respectfully suggest to your committee that it should start discussing and studying cases in the real life environment. It has been our impression that up to now it has worked to establish the theoretical model upon which to recommend criteria to government for the implementation of its science policy. We suggest that unless practical, tangible cases are studied now, the situation will have changed so much that the assumptions on which the recommendations were based will not be valid any more.

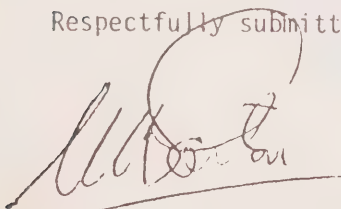
We respectfully urge your committee to recommend that the federal government state clearly and publicly its policy towards the future of the research-oriented pharmaceutical industry. We appear to be unwanted in Canada. We should be told clearly if research and development are not to be considered as a factor in establishing the price of our products in Canada.

The innovative pharmaceutical industry is becoming more and more unstable and unprofitable through government plans which certainly makes the research climate most unfavorable for the establishment of long-term goals and the construction at considerable cost of pharmaceutical research establishments.

We hope you may find it within your terms of reference to recommend that the Patent Act be modified with a view to removing the discrimination with which research in our industry is faced. It is our firm belief that the Canadian scientific community will otherwise be the loser.

We will be pleased to discuss these matters with you at your convenience.

Respectfully submitted,



Major General W.M. Garton (Ret'd)  
President.  
Encls.

### RECOMMENDATIONS

PMAC would like to conclude this commentary with the following recommendations:

1. *That recognition be given to the importance of the development of new drugs, by reason of the social and economic benefits which they confer, and that the Canadian pharmaceutical industry be encouraged to play a larger and more direct role in this process than they have been able to do in the past.*
2. *That research, development and innovation be encouraged within the pharmaceutical industry by improvement of the climate in which such activities are to be carried out in Canada ("a re-orientation or re-tooling of some of the policy instruments").<sup>(1)</sup> Specifically, PMAC recommends revision of section 41 of the Patent Act, particularly with respect to encouragement and protection of the Canadian participation in the invention, or the establishment of a system of royalties which would compensate for the total cost of the innovative process defined as "a conscious sequence of events covering the whole process of creating and offering goods or services that are either new or better, or cheaper than those previously available".<sup>(2)</sup>*

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(1) Hon. Jean-Luc Pepin, "Notes on Industrial Strategy for Canada", Canadian Chamber of Commerce Annual Meeting, Ottawa, September 20, 1972.

(2) The Science Council of Canada, The Canadian Forum, June, 1972, p. 27.

## (ii)

3. *That encouragement be directed towards general increases in research and innovative capacity and towards mission-oriented projects, which would include joint industry-government ventures or contract research. The preferred financial support for the general phase should be tax incentives, although grants may be appropriate to particular situations.*
  
4. *That in the total public interest certain research activities, related to the drug innovative process, such as clinical pharmacology and the study of bioavailability, receive more attention from governmental funding agencies in the future than they have up until now, and that the government, universities and industry establish, in co-operation, a crash program for training and research in these fields with the objective that an increasing amount of this type of research be done in Canada.*

SCIENCE POLICY FOR CANADAA Review

by the

Pharmaceutical Manufacturers Association of Canada

of Volume 3 of the

Senate Special Committee on Science Policy

(Lamontagne Report)

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SUMMARY

In the Introduction to this review of Volume 3 of the Report of the Senate Special Committee on Science Policy, PMAC identifies three themes as emerging from the report: 1) the connection between basic and applied research is not a continuum; 2) the most efficient method leading to innovation is the demand-pull principle associated with cost-benefit analysis; and 3) the best organizational model for science policy in Canada is the concerted action model. The review discusses these three themes, with which PMAC is, for the most part, in agreement. Concerning the concerted action model in particular, PMAC argues for the necessity of a high degree of flexibility in its application.

The review then goes on to describe briefly the recommendations of the Special Committee as they relate to the establishment of science policy in Canada.

Finally, each recommendation is examined and commented upon in some detail. Several points are emphasized by PMAC in this review:

- 1) The Science Council should have a young active representation, coming predominantly from the industrial sector.



- 2) Additional funds for the Medical Research Council are urged, particularly if the area it is to support is to include all the Life Sciences.
- 3) The importance of consistency between the non-spending instruments of policy, particularly in the regulatory area, and the establishment of a science policy is stressed, and the pharmaceutical industry is presented as an example of how lack of such consistency has been a barrier to a successful development of its innovative potential in Canada.
- 4) PMAC argues against what is characterized by the Special Committee as the "threat" of large multinational corporations, and points out that lack of government policy is the prime reason for Canada's being a "branch-plant" economy. PMAC considers that, inter alia, government should stress even more than it has in the past, the right of a Canadian affiliate to develop export markets for any new product resulting from government-aided R & D effort.
- 5) PMAC is critical of the role assigned by the Special Committee to the Royal Society and SCITEC as the chief sources of extra-governmental information and advice to the Ministry of State for Science and Technology. This is because, although PMAC recognizes the need for such an outside source, it doubts whether either the Royal Society, or SCITEC, as presently structured, represents a broad scientific and engineering constituency.
- 6) PMAC emphasizes the need for fiscal autonomy for special advisers to governmental agencies, if their advice is to be truly independent.







Government  
Publications

FIRST SESSION—THIRTIETH PARLIAMENT

1974-76

THE SENATE OF CANADA  
PROCEEDINGS OF THE  
SPECIAL COMMITTEE OF THE SENATE ON  
**SCIENCE POLICY**

The Honourable MAURICE LAMONTAGNE, P.C., *Chairman*

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Issue No. 20

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THURSDAY, AUGUST 12, 1976

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**Twentieth Proceedings on:**

The Study of Canadian Government and  
other expenditures on scientific activities  
and matters related thereto.

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(Witnesses and appendix: See Minutes of Proceedings)



THE SPECIAL COMMITTEE OF THE  
SENATE ON SCIENCE POLICY

The Honourable Maurice Lamontagne, P.C., *Chairman*

The Honourable Donald Cameron, *Deputy Chairman*

and

The Honourable Senators:

Asselin	Hastings
Bélisle	Hicks
Bell	Lang
Blois	Manning
Bonnell	Neiman
Bourget	Riel
Buckwold	Robichaud
Carter	Rowe
Giguère	Stanbury
Godfrey	Thompson
Goldenberg	van Roggen
Grosart	Yuzyk
Haig	

27 Members

(Quorum 5)

# Order of Reference

Extract from the First Report of the Special Committee of the Senate on Science Policy, presented on July 10, 1975 and printed as an Appendix to the Minutes of the Proceedings of the Senate of that day, and adopted by the Senate on July 24, 1975:

"The Committee, therefore, recommends that it be authorized to consider and report on Canadian government and other expenditures on scientific activities and matters related thereto;

That the Committee have power to engage the services of such counsel and clerical personnel as may be necessary for the purpose of the inquiry;

That the Committee have power to send for persons, papers and records, to sit during adjournments of the Senate and to report from time to time; and

That the Committee be authorized to print such papers and evidence from day to day as may be ordered by the Committee."

Robert Fortier,  
*Clerk of the Senate.*

# Minutes of Proceedings

Thursday, August 12, 1976  
(30)

Pursuant to adjournment and notice the Special Committee of the Senate on Science Policy met this day at 2:35 p.m., the Chairman, the Honourable Senator Lamontagne, presiding.

*Present:* The Honourable Senators Bell, Buckwold, Godfrey, Lamontagne and Yuzyk. (5)

*In attendance:* Mr. Philip J. Pocock, Director of Research, and Jacques Ostiguy, Chief of Administration.

The Committee resumed consideration of its Order of Reference dated July 24, 1975 relating to the study of Canadian Government and other expenditures on scientific activities and matters related thereto.

The following witnesses from *The Royal Society of Canada* were heard:

Dr. J. Larkin Kerwin,  
President of the Royal  
Society of Canada,  
Rector, Laval University;

Dr. W. Bennett Lewis,  
President, Academy of Science  
of the Royal Society of Canada,  
Professor, Queen's University;

Dr. S. Delbert Clark,  
Past President of the Royal  
Society of Canada,  
Professor, University of Guelph;

Dr. Donald G. Hurst,  
Fellow of the Royal Society of  
Canada,  
Executive Director of the  
Royal Society of Canada;

Dr. Donald J. LeRoy,  
Fellow of the Royal Society  
of Canada,  
Principal Research Officer,  
National Research Council  
of Canada.

On Motion by the Honourable Senator Bell, it was Agreed that the brief presented to the Committee by the Royal Society of Canada be printed as an appendix to this day's Minutes of Proceedings and Evidence. (*See Appendix No. "35"*)

Dr. Kerwin made an opening statement. The witnesses then answered questions put to them by Members of the

Committee.

At 4:07 p.m. the Committee adjourned until the call of the Chairman.

ATTEST:

Patrick Savoie,  
*Clerk of the Committee.*

# The Special Committee of the Senate on Science Policy

## Evidence

Ottawa, Thursday, August 12, 1976

The Special Committee of the Senate on Science Policy met this day at 2.30 p.m. to consider Canadian government and other expenditures on scientific activities and matters relating thereto.

**Senator Maurice Lamontagne** (*Chairman*) in the Chair.

**The Chairman:** Honourable senators, this afternoon I must declare a conflict of interest, but this is not the first time that this committee has faced this situation. I might say that I have a double conflict of interest in the sense that I am a member of the Royal Society, and this year the Royal Society is honoured to have as its president the rector of the University of Laval, where I have taught for quite a number of years and from which university I have an honorary degree. So at this stage I want to declare my interest.

We are very proud indeed to have the Royal Society with us today, and Dr. Kerwin, who is on my right, is the new president of the Royal Society and is at the same time the rector of Laval University. So I would ask him at this stage to introduce the rest of the delegation.

**Dr. J. Larkin Kerwin, President of the Royal Society of Canada; Rector, Laval University:**

[*Translation*]

... Thank you, Mr. Chairman. I am pleased to have with me Professor Del Clark ...

[*Text*]

who is the immediate past president of the Royal Society of Canada and a professor at Toronto. Also I have on my right Dr. Bennet Lewis, president of the Academy of Science of the Society; Dr. Don LeRoy, who is a principal research officer at the National Research Council of Canada; and then Dr. Don Hurst, on my far right, who is the executive director of the Royal Society.

**The Chairman:** Thank you very much. Now we have the perennial problem of the printing of briefs and submissions to our proceedings, and I would propose that the letter I received as chairman of the committee from the past president, Dr. Clark, and annex No. 1 to this letter and annex No. 2, with the exception of the enumeration of international non-governmental organizations, be printed as part of the proceedings; that is to say, as an appendix to the proceedings of today.

**Senator Bell:** I so move.

**Senator Godfrey:** Seconded.

**The Chairman:** Carried.

(*For text, see Appendix No. "35"*)

[*Translation*]

**The Chairman:** I understand, Dr. Kerwin, that you have a statement to make?

**Dr. Kerwin:** With your permission, Mr. Chairman, I do indeed. First, I should like to thank you and the members of your Committee for inviting us to come and discuss with you the present state of science in Canada. The Royal Society of Canada is extremely interested in the subject, and the activities of our three academies over the last few years have reflected our interest in and the priority we give to this particular question.

In response to your letter and your questions, I am sorry to have to tell you that the last few years have generally been disturbing and even alarming ones for us.

The great debate on science policy in Canada has, frankly, produced little in the way of concrete and interesting results. The grant-giving agencies that you recommended have not been set up, and the existing agencies have grown weaker. There has been a considerable decline in the amount of support given to science outside the government context. The situation for science in Canada is poor. In addition, Mr. Chairman, the country is already feeling the effects on a human scale. The reservoir of talent that we need to face the social and economic challenges of the future has been depleted. It is most unfortunate, in these times, to find that scientists are expending all their efforts on trying to maintain their present staff allotments rather than on preparing for the future.

In short, after five years the Society finds that Canadian policy on scientific development has taken a backward step.

[*Text*]

In our presentation today the Society does not intend to take up again the over-all question of science policy. Its views as presented to the Senate committee some years ago still hold, by and large. Rather we propose to review the state of those recommendations which you made and which concern the Society in a direct way and then we wish to make three specific *ad hoc* recommendations of our own which would improve, in our view, the present sorry climate for science in Canada.

Of the five Senate committee recommendations which touched on the Society directly, one concerned its desirable role as coordinator of Canada's activities in international non-governmental science. In most countries this is indeed one of the usual roles of the National Academy. Since the Senate committee report the Society has worked vigorously and constantly towards this purpose. Its committee on international affairs has proposed several mechanisms whereby the Society might assist in the management of these complex dossiers. One important factor necessary to the fulfilment of the Senate committee's recommendation



is the need to obtain the co-operation and consent of the various disciplinary groups in the country. To this end the Royal Society convened about a score of these groups last spring, and proposed a co-operative scheme whereby they and the Society could take over the responsibility for one part of the organizations, those non-governmental units covered by the ICSU umbrella and which is presently handled by a committee of the National Research Council.

**The Chairman:** I am sorry to interrupt, but Senator Bell raised a grievance yesterday, and quite properly so about the use of these initials. Would you explain to us what ICSU is?

**Dr. Kerwin:** ICSU is an acronym for the International Council of Scientific Unions, and it has been described as the scientific arm of UNESCO. It is the umbrella organization which groups together in a federation all of the scientific unions. Now a scientific union in turn is a grouping, for example, of all the chemists from the various developed countries into one union. There is another one which groups the physicists and another which groups the astronomers, another for the mathematicians and so on. There are about 35 of these groups which are in turn federated into ICSU and through ICSU they do a lot of work for UNESCO and plan international science. Well, Canada belongs to most of these unions and the coordination of it all is presently handled by a committee of the National Research Council, and it is this particular group which covers the pure sciences; it does not touch, by and large, the applied sciences and a number of others. This group of pure sciences is the one that the Society is presently concentrating its efforts on.

This proposal that we discussed at this meeting is now to be submitted to the assemblies of the various Canadian disciplinary groups and the few replies that we have received to date—because these meetings usually have not usually been held—have been favourable. The Royal Society is also prepared to act in other fields of non-governmental science in co-operation with the existing associations whether they be of the medical sciences, the biological sciences, the engineering sciences or others and also the social sciences and the humanities as evolving circumstances may permit. It has already assumed responsibility for Canada's participation in the International Science Foundation which is based in Sweden, and therefore on your first recommendation we report very definite progress.

In the second recommendation the Senate committee expressed the desire to see better liaison between the Parliament of Canada and the scientific community. Our society is in agreement with this view. It has itself held a preliminary meeting with some of the members of Parliament and has learned with satisfaction of SCITEC's—which is the Federation of Scientific and Technological Associations of Canada—plans to meet with some members of the House of Commons. The Royal Society now plans to invite representatives of the Senate, the House of Commons and SCITEC to discuss with it further ways of implementing this recommendation. We hope to arrange for such a meeting in the coming fall.

In a third recommendation the Senate committee suggested that the Royal Society and SCITEC be recognized by MOSST, the Ministry of State for Science and Technology, as the spokesman for Canadian science. In fact liaison between the Society and MOSST has been increased and has been useful and cordial. We understand that the same is true of SCITEC. However, we must reiter-

ate in this context that the Society does not consider that it can speak for Canadian scientists as such. Rather it acts as a convenient and effective channel for transmitting the views of scientists, particularly on interdisciplinary matters and on questions which interface the natural sciences, the social sciences and the humanities.

[Translation]

Mr. Chairman, your fourth recommendation of direct concern to the society was that the Ministry of State for Science and Technology should deal with the Royal Society in accordance with the policy governing the granting of contracts. Considerable progress has been made in acting upon that recommendation, for the Society was granted an initial contract by the Ministry, formed a planning committee, appointed an executive director and increased office staff. We have submitted thirty-three contract proposals to the Ministry on various aspects of science as it affects Canadian life in general and, through the Ministry, we have helped to allocate these contracts to all the departments and services involved. We have already started negotiations with departments on some of these proposals. In short, your Committee's fourth recommendation has been acted upon.

The Senate Committee also recommended that the Royal Society and the Association of Scientists, Technologists and Engineers of Canada (SCITEC) should receive grants for support purposes from the government. This is, of course, a sensible recommendation which the Society fully supports and which, we hope, will be followed up on the scale indicated here. We should point out in passing that, although the financing of certain projects by contract is to be commended, it cannot in itself take the place of financing through a regular grant system such as the one you have recommended.

In short, Mr. Chairman, it is clear that the Royal Society of Canada has, to the extent that it can take initiatives in such matters, vigorously followed up the Committee's recommendations.

[Text]

Having made this report, Mr. Chairman, I would like to turn now very quickly to three specific *ad hoc* recommendations which the Royal Society wishes to make in view of the present alarming context of Canadian science.

The first concerns the scientific base built up in Canada over the past two generations. This base is necessary in order to have the necessary scientific and technological expertise required to achieve national goals. This base is necessary even when we are importing technology, if we are to get optimum use out of the imports. It is this base which has been and is being eroded over the past few years. The Royal Society recommends that this base be maintained. The recommendation implies that the effective reduction in purchasing power for research and development be stopped and that equipment be maintained and renewed in normal fashion.

[Translation]

On this matter, Mr. Chairman, I would like to point out that the present situation is not new, and in fact dates back more than 200 years. I have here a book on the siege of Quebec City in 1759 containing the manuscript reports of three eyewitnesses. I would like to read to you what happened during the siege of Quebec City.

**Senator Lamontagne:** When the English came.

**Dr. Kerwin:** Just before. It was feared that the English would, with the help of their pilot boats, be able to sail their ocean-going vessels as far as Quebec City. It was known that "off the Ile d'Orléans there was a passage called La Traverse, which was difficult of access", and accordingly the following decision was made—and I quote from a Quebecer's eyewitness report of the events of 1759:

Council was then held to consider such obstacles as could hinder the enemy in the waters; the decision was made to float two or three large merchantmen down to the place called La Traverse, which, all our sailors boldly claimed, was not even 100 fathoms wide; success was certain, they said, because only one vessel could pass through at a time.

As a precaution, scouts were sent to take soundings of the passage. They reported that it measured 900 fathoms across and that almost an entire fleet could pass through at one time. This caused as much surprise as did the news of the enemy's arrival, so great was the government's ignorance even of events taking place ten leagues from the capital.

Mr. Chairman, these words could be applied without alteration to several of today's issues. If I may continue, the officer of the port of Quebec was criticized for not having known the width of the passage. He replied—and I quote—:

...that in truth he had not sounded the passage for twenty-five years, but that the last time he had proposed to do so, he had been denied the necessary sums.

That, Senator Lamontagne, was two hundred years ago....

[Text]

**Senator Godfrey:** The English will be grateful for that.

**Dr. Kerwin:** A little later, in fact, the English admiral did sail his entire fleet abreast of the St. Lawrence as predicted.

**The Chairman:** If we had had the proper research at that time we would not need to separate!

**Dr. Kerwin:** Our first recommendation implies that this country must maintain its scientific base in order that it will not be caught in ignorance when crises arise, whether it be swine flu, energy or the arrival of a new British fleet!

Our second recommendation concerns the granting councils, NRC, the Medical Research Council, Canada Council, and the other traditional grant sources, such as were the Defence Research Board, the Atomic Energy Control Board and several granting ministries. In latter years their various responsibilities have been in part reallocated, but the overall research budget which they administered has fallen badly behind inflation, as we have been reminded every week for the last two years. The Royal Society of Canada recommends that this budget be restored to the operative agencies; that is, that the purchasing power of, say, three years ago be restored to the ensemble of grantees and maintained until the return to a period of normal growth.

Our third specific recommendation concerns the efficiency of research in areas of concern to major national goals. The Society recommends that several such goals be specified and that a number of laboratories or centres be

designated or created corresponding to them, and charged simultaneously both with carrying out research pertinent to these goals and with co-ordinating other federal government research in the field. Such laboratories or centres will thus become the specific focus for research for each specified goal. Many such goals have been suggested by other groups, such as the Science Council, and the subject is well documented. Several are presently the object of major research efforts. Our recommendations seek to achieve better co-ordination and increased priority. Such areas of study might include the forecasting of climatic changes for the medium and long range, the management of the continental shelf, the further development of forest resources, and so on.

[Translation]

Senator Lamontagne, the Royal Society of Canada hopes that the debate on Canada's science policy and scientific structures will lead in the very near future to the designation of specific national goals, to adequate financing of the research required to attain those goals, and to the maintenance of the scientific base needed to meet new challenges.

Mr. Chairman, we have not come with the intention of submitting to you a vast amount of information and presenting a summary of our ideas on all the problems facing science in Canada. In view of the stage which your Committee has reached, we felt that you would find it more useful if the number of new suggestions were kept to the minimum. We have therefore limited ourselves to a report on the five recommendations and to three suggestions which were provoked by the critical period through which scientific research in Canada is now passing.

My colleagues are ready, Senator Lamontagne, to give you additional information, to shed further light on my statements, and, of course, to answer your questions.

**The Chairman:** Dr. Kerwin, I first have a request to make. I would very much like to have a copy of the book from which you quoted a few moments ago.

**Dr. Kerwin:** You shall have it next week.

**The Chairman:** I should also like to congratulate you on the brevity of your presentation. We have had reports and papers of 800 or 900 pages, and I must say that in terms of the objectives of our inquiry, these interminable reports are not very useful to us. I therefore admire your concession and the way you concentrated on the major questions. Without more ado,

[Text]

I should like Senator Buckwold to start the question period.

**Senator Buckwold:** Thank you very much, Mr. Chairman. I am sure I speak for all senators in thanking the president for his presentation.

My first question will be a general one. Over and over again we hear the word "crisis." Here I quote your closing statement. We hear about the present sorry climate for science in Canada; we are relating it to some drop in expenditure, which is significant, but nevertheless certainly a lot of money is still going into scientific research and development. I wonder whether you could be a little more explicit about what you mean by "crisis". Are we getting fewer students at universities moving into the sciences? Is the "brain drain" continuing? If students do graduate, are



they able to get employment in their respective disciplines? I would like to hear a little bit more about this crisis, other than just a general statement.

**Dr. Kerwin:** I can give you two aspects of the reply, and my colleagues can certainly add to it. On the specific level, in almost every university in Canada you will find situations similar to that of my own. We have had to dismiss 30 of 80 technicians working on research projects in our Faculty of Science and Engineering. We have had to stop the recruiting of 30 researchers whom we had intended to place on projects for the year starting in September. I am speaking of PH.D. level recruiting that we intended to do. This summer we have lost three of our younger and more brilliant engineering professors, who had wished to undertake a career in research, but we had to tell them that the projects they had in mind just would not bear financing; there was no question of getting any money for them. This answer concerns people. We have been fortunate in obtaining for Canada over the past few years a major—although not one of the largest in the world—nuclear accelerators, called Triumph, and we are very fortunate to have done so.

**Senator Buckwold:** That is in Vancouver.

**Dr. Kerwin:** In Vancouver.

**Senator Buckwold:** They have got one in Saskatoon too.

**The Chairman:** Senator Buckwold comes from Saskatchewan.

**Senator Godfrey:** From Saskatoon. You ought to have guessed that.

**The Chairman:** Not Saskatchewan, Saskatoon.

**Dr. Kerwin:** I am intimately familiar with both the old Betatron of Saskatoon, from which Mr. Katz got more mileage than any other North American physicist, and, of course, the linear accelerator, some years ago, and it was my privilege to be on the visiting committee that inspected it several times. Installations such as those at Saskatoon are small. There are several in many Canadian universities. It is only Triumph that puts us in the forefront of nuclear research at the present moment. It was usually understood, and at least hopeful, that there would be an eastern Canadian facility developed, and plans for one have gone very far indeed. All the people involved in it are now rather resigned to the fact that they will not see this facility, so this very important nuclear physics community of the eastern Canadian universities is turning to other matters.

Another point in support of the crisis attitude is the fact that at my university the graduate students in engineering have just about disappeared. The reason is that we cannot support them, whereas industry is offering them normal salaries for the present economic climate of the country. This means that they can be hired at \$15,000 to \$17,000, just out of university, as engineers in industry, and even in some government ministries. We can offer them only about \$7,000 or \$8,000 for staying on as graduate students to get a masters degree, and when they do get a masters degree it does not count all that much in their salaries, so they figure they are losers.

Beyond that, we cannot finance new projects, and the old projects that we worked up several years ago are now beginning to have all the juice drained out of them; and the thesis topics that we can assign, with old projects and old equipment are not all that interesting. Therefore, the

graduate school ranks in our School of Engineering have thinned out practically to the vanishing point. Those are specific examples.

The second part of my reply would be more general. I refer to the recently issued report of the President of the National Research Council, at the beginning of which you will find several graphs and diagrams, commented on by Dr. Schneider, which compare the effective purchasing power that Canada has put into research and development this year with the previous years, and all of the curves are going down drastically. I am sure you have this report, and this is very definite evidence that we have cut our purchasing power by the order of 50 per cent over the past few years.

On the industrial side, we have seen the closing of the research labs of RCA Victor of Montreal. This was one of the few industrial labs that we had in French Canada, carrying out fundamental research, and now it is closed.

**Senator Godfrey:** I would like you to explain the reason for RCA Victor closing down. I saw that in the paper and was very disturbed about it.

**Dr. Kerwin:** I am not certain.

**Senator Godfrey:** Is it the fault of government policy? Is there anything we could have done about that?

**Dr. Kerwin:** I think the prime reason was no doubt a decision made by the parent company in the United States, but the climate for research and the ability to co-operate with university laboratories as they had in the past had fallen off a great deal, because we are simply not up to par in many of the subjects they were pursuing. I believe that the deterioration of the climate was one of the reasons that certainly the parent company would have invoked in closing this laboratory. Possibly one of my colleagues would have further information on this point. I know that Dr. Lewis would like to add much to what I have just said.

**Dr. W. B. Lewis, Professor, Queen's University:** I am not really happy with listing further examples.

**The Chairman:** We like examples.

**Senator Godfrey:** They help us, so if you are not happy, we are happy.

**Dr. Lewis:** Of course, RCA Victor is small in the space communication industry compared with Bell Northern, so that we have a larger organization that is surviving, but, let us say, none too happily in this present climate. This RCA Victor research group was brought into being by research contracts connected with Canadian defence, but they have contributed quite considerably to communications. This is not a new story. Just last week I noticed in the *Globe and Mail* someone getting after the question of the cost of telephone communication across the country. This, of course, is carried largely physically by microwave repeaters, and RCA Victor was very definitely in that business. The statement made in the *Globe and Mail* was that someone in Toronto spending ten minutes on a Saturday afternoon speaking to somebody in Vancouver finds his bill comes to something over \$11, whereas somebody in New York speaking to somebody in Seattle would find his bill about \$3. This is something that I have been drawing to the government's attention since 1962. I have said that we really should look for a positive move in this direction. There is no reason why I should not be able to speak to my friend in Tokyo for no more than \$1 for three minutes.

However, these facilities just do not appear; they are not there yet. In other words, we have deliberately by our policy priced our communications into the situation that they are expensive and not too good. Why should we not be good? We are in an ideal situation, linking the world; we have the polar cap; we really could talk to people very cheaply. We have the technology; if it is not there, it could very quickly be worked up. This is just giving one example of where we say we would like there to be major policy items and science will be called up by it.

What I said in 1962 was that in the last century it was considered rather an innovation to have penny post. We have lost it now, but its idea was good and I said why should not this century be known for the 50-cent telephone call — call it a dollar, if you like, but to go anywhere across the globe is quite within our possibilities and, of course, it would be economically sound if it was sufficiently used.

**The Chairman:** We have a slogan on French TV, "Let's talk to each other," so I hope that you will be able to reduce these long distance calls.

**Senator Buckwold:** As a little humour, Mr. Chairman, I heard that the postal rate will be raised by 10 cents; 3 cents for delivery and 7 cents for storage.

However, I am still not satisfied with the response. You have indicated, for example, that in your engineering faculty your Master's program has practically disappeared. What about the other scientific fields? Are universities right across the country finding that people are not moving into Master's or Ph.D. programs?

**Dr. Lewis:** I believe that in each university you will find some departments that are suffering in this way. At Queen's engineering physics is approximately the same as a little while ago, but our chemistry is not, and I think you can find something similar in each university. I have visited quite a number.

**Senator Buckwold:** Is it all due to money?

**Dr. Lewis:** The money is the symptom of the malaise, which is that no encouragement is being given because everyone feels responsible that they should only encourage things where they can see the money coming, and certainly we do not find this in Canada.

**The Chairman:** Are we not facing a vicious circle in this?

**Dr. Lewis:** Yes.

**The Chairman:** The government cannot fire scientists when they are getting older; you are a very distinguished retired scientist.

**Dr. Lewis:** I am on pension now.

**The Chairman:** I know. We have been faced with the situation in which the age distribution of researchers in government labs is going up all the time, so that there are less job opportunities. I suppose that in universities, since the support for research in universities is being reduced in constant dollars, our councils tend to support those who have established a kind of reputation in a certain field, so that there are less job opportunities or less grants at the beginning for young Canadian scientists to get into a research career. Then they do not find job opportunities at the end. Is that not the type of vicious circle which we face at the moment?

**Dr. Kerwin:** Mr. Chairman, if you will permit me to make a comparison, our Minister of Science and Technology has described Canada as a branch plant country and that, therefore, we should only expect to do branch plant research. Now, Sweden does not consider itself to be a branch plant country and figures it has to solve its own problems. As a result, there are six times more forestry engineers there, although the forests of Sweden are only comparable and, indeed, a little less than similar forests in Canada. However, we have been so used to cutting down forests and shipping the wood off to Europe and elsewhere that that is the situation.

**The Chairman:** You are fighting the Indians.

**Dr. Kerwin:** It means that forest management does not seem to be part of our tradition, in spite of its being one of our major natural resources, and the country as a whole does not find it appropriate to put into forestry the efforts that are put into forestry in Sweden. Therefore, our forestry schools do not have the same dimensions and the same significance is not given to them. If we are, indeed, destined for ever to be a branch plant country and just to wait and see what happens south of the border, then to see how best we can go along with it, this climate and attitude will prevail and we will be a branch plant country.

Well, the Royal Society is of the opinion that this is neither true nor necessary, that we can behave as Sweden does with our forests and as other countries do in other fields and that the question of investing reasonable amounts in the research and development necessary to have good, healthy, forward-looking fisheries, forward-looking forestry managements, continental shelf management, communications networks and so on are all natural, normal things for a country of our size to do. However, if we believe that we are a tributary, satellite appendage, this mentality itself is enough to destroy the suitable opportunities of investment and development. It is this which the Royal Society is protesting.

**Senator Godfrey:** This morning we heard from the Canadian Manufacturers' Association that they want the government to keep out of it and give them more money, but why should not a forest industry of the size we have carry out the research of which you speak?

**Dr. Kerwin:** The government must do something, so must industry and the universities. There are only six schools of forestry in Canada, one being at my university, and possibly we are not doing enough for our forestry faculty compared with other faculties. We asked ourselves that question a few years ago and decided that we were not and have increased it considerably. However, this is a local, isolated phenomenon that I am able to give as an example. If everyone were to do his part, the cumulative effect would be rewarding. This is a simple thing to say, "if everyone were to do his part," but it is a fact that the country must be aroused to a sense of urgency and crisis sufficiently that everyone will feel inclined to take his responsibility. So in speaking to you as a committee of the Senate, we are not berating the government. We do not think that it does its share; in fact, it has been negative over the past few years. However, everyone must do his share.

**Dr. Lewis:** I expect you have noticed in the newspapers items with respect to the spruce budworm and the white pine blister rust. These things appear in the newspapers at the stage when there is a crisis. However, they are not



unknown in science, but trees are slow-growing things and it takes 30 or 40 years from the understanding of the disease to being able to think about the whole framework of control. This scientific base just does not exist in this country, although when it came to the International Institute of Applied Systems analysis our forestry information with respect to spruce budworm was found to be one of the best in the world. There is nothing wrong with our science, but we want more of it.

**Senator Godfrey:** The spruce budworm has been around one or two hundred years.

**Dr. Lewis:** Sure, but we are just tinkering with it still.

**Senator Buckwold:** It is well that we are aware that there is this crisis. We have heard of some isolated instances, but I do not believe we have all the evidence. For example, is the student interest in science at the Bachelor level maintaining itself?

**Dr. Kerwin:** Mr. Chairman, if I may take the example of my university, which is typical in this respect, we have had an increase in enrolment of more than 40 per cent in three years.

**The Chairman:** Don't tell me that Laval is typical.

**Dr. Kerwin:** No, but this proportion is typical, that the science faculty has not participated in this enrolment. It has shot up in political science, economics and administration for several years, but in teaching and education last year it levelled off, and in science it is only a few per cent. This is symptomatic of a very deep ill. It appears that little enthusiasm for science is being generated at the secondary school level. First of all, there was during the sixties a social stigma attached to science, which was blamed for many of the ills of the environment and the social climate. This stigma remains with the young teachers who went into operation then, and, apparently, are still having an effect on the students. Also there is a disinclination to work among high school students, as everywhere else. If it is much easier to get through high school without taking the mathematics profile, that is what they prefer to do. Becoming a scientist, an economist and other mathematically-oriented disciplines is hard work and the spirit of hard work, as everyone seems to agree, has deteriorated a great deal.

I even have students at the university complaining that they have to work a 30-hour week. It is well known that no university student can get by without a 60-hour week if he is to do justice to himself.

**The Chairman:** I would like to hear from Professor Clark of the University of Toronto.

**Dr. S. Delbert Clark, Past President of the Royal Society of Canada, Professor, University of Toronto:** I would agree. I am afraid I am not as competent as the Rector of Laval, but certainly that has been the trend at the University of Toronto.

**The Chairman:** Did you have a great surge of enrolment in the field of sociology, which is your field, as opposed to engineering?

**Dr. Clark:** Yes, which I attributed to hippyism and black riots. The president in speaking to the dean a few years ago was speaking, as a result, of closing down the Department of Physics. I pleaded that if they were going to close any department down, close the Department of Sociology and

they would not lose a damn thing. But to close down the Department of Physics and lose the scientists of the country would be a very serious matter. I should qualify my reference to the Department of Sociology, but it would be very serious.

**Senator Buckwold:** I would have liked to raise the question of the effect of the new style educational programs in high school math teaching, interest in scientific endeavours, et cetera, and the effect of that at the university level, especially in post-graduate work. However, that is not our function today.

I wanted to discuss with the witnesses this afternoon, Mr. Chairman, some of the aspects of our previous reports. I was glad to hear that at least some of the five recommendations have been implemented in part. I am not quite sure whether the word "vigorous" activity on the part of the Royal Society—I think that was the word you used—would be appropriately descriptive. It seems to me that it has taken a long time for the Royal Society to call a meeting of the various disciplines to discuss representation at the international level. Our report was published in 1973 and that meeting did not take place until this past spring.

I am not being critical. I am simply pointing out that the Royal Society has not been as active as had been hoped. I presume the initiative was, or should have been, on the part of the society.

**The Chairman:** Perhaps we could interrupt your questioning at this stage, Senator Buckwold, and have the comments of our witnesses on the steps that have been taken with the government in respect of the recommendations we made.

**Dr. Clark:** Mr. Chairman, if I might comment on the senator's remarks, my answer is that for a problem as difficult and complex as this one, three years is a very short period of time. I think I can safely say that the society has worked vigorously—indeed, for more than three years—to resolve this problem of international representation. The fact that the meeting only took place this past spring should not be construed as being the first move the society made in this regard. It has worked continuously on it.

It is a very difficult problem, as the president suggested in the brief. Hackles were aroused on the part of the various discipline groups, and to move faster would have been disastrous. I think we had to move very carefully on this one, but we have moved steadfastly forward.

**The Chairman:** I presume, also, you had to commence the dialogue with the government.

**Dr. Clark:** Yes, but I think the difficult problem, and one which had to be initially resolved, was the matter of representation. It was not for the society to simply barge in on the basis that it was going to represent the scientific community in these international gatherings.

**Dr. Kerwin:** Mr. Chairman, I mentioned that our International Affairs Committee had proposed several schemes that would have answered your recommendation. These schemes were discussed, both with other groups and with the government, over the last three-year period. The meeting to which I referred was the one that was held to discuss the latest scheme, which appears to be the most palatable and the most acceptable. In fact, we have evidence that it is going to be accepted. However, there were other schemes discussed during that period.

**The Chairman:** When Dr. Schneider was before the committee he mentioned that there had been a good deal of progress in the transferring of responsibilities between the National Research Council, in terms of international representation at the private level, and the Royal Society. Could you elaborate on the negotiations leading to this transfer of responsibilities?

**Dr. Kerwin:** The National Research Council, of course, has been managing the ICSU affairs, and others, for many years, and has been doing so very successfully. The drawback to this arrangement, of course, is that the National Research Council is a government agency and, therefore, its delegates have to be careful not to contradict government policy during these meetings, notwithstanding that they are talking with non-governmental groups. The fact that other academies can speak to these questions without being so constrained is of great use. That is where they fly all kinds of political balloons and get all kinds of reactions, and where the diplomatic barriers are lowered. Canada is about the only country that places these constraints on its representatives when they go abroad.

NRC has been doing an excellent job, a very conscientious job, and it did not want to turn over this responsibility without being assured that there would be continuity, that the job would be well done and that the scientific community would be thoroughly consulted. This transfer has taken a long time. The objection and prudent precaution on the part of the council in this regard is well founded, I think. It has taken us two and one-half years to answer that objection and precaution, but we feel we are well under way now in respect of the particular group of pure sciences represented by the ICSU umbrella.

**Senator Buckwold:** I have one final question, Mr. Chairman, which may be somewhat off the general presentation, and I hope some other members of the committee will talk about the specific recommendations of the society, with which I agree in principle. I cannot find anything wrong with what the society has suggested as the three specifics.

I want to talk about the public responsibility of the Royal Society. The society has already conducted, for example, on its own initiative, a study of mercury poisoning in some of our waterways. Yesterday, we had a very full discussion on the future of nuclear power development. We expressed the concern of many people about the dangers of nuclear power, the effects of plutonium, and so forth.

Is it possible for more of this kind of initiative to be taken by your many disciplines in order to carry out scientific investigation at a non-governmental, non-political level, with the aim of drawing to the attention of Canadians the scientific facts of these situations? Certainly, there is a great deal of confusion. If the government comes in with a study, it is sometimes accused of its own political bias. I feel there is a very real role for the Royal Society to play in this regard, and I would like to get your comments on it.

**Dr. Kerwin:** You could not have asked a question that would delight us more, Senator Buckwold. I hope my answer will not give members of the committee the idea that the question was planted.

**The Chairman:** We have had that experience before.

**Dr. Kerwin:** The fact is that such activities are very much in our minds. In fact, they have been implemented in

certain cases. This stems from one of the earlier recommendations of this committee.

We have in the past six months drawn up a list of 33 projects of national interest which the Royal Society is well qualified to investigate. We are in a position to draw on the necessary experts—objective people, good writers—in the areas covered by these 33 projects, and we are willing and eager to undertake these studies.

**The Chairman:** These individuals would not necessarily be fellows of the Royal Society?

**Dr. Kerwin:** The studies would be undertaken by teams of experts organized and coordinated by the Royal Society. Many of the individuals involved would be fellows of the society, because we always try to elect the leading people in the various disciplines, judged by their peers, to fellowship in the Royal Society. It would include other experts as well.

These studies would try to set before the public, as we did in the case of mercury, the facts on which they can then base their judgments. On many questions today—and the mercury questions is one of them—there is a great deal of emotion that goes into people's reactions. Another example of this is the question of nuclear energy. There is much to be said for nuclear energy and much to be said against it. Unfortunately, much of what is said for and against nuclear energy through the media is of an emotional nature.

I have today's paper in my briefcase and it reports that yesterday, when Hydro-Quebec proposed to the committee of the National Assembly that it spend \$51 billion on developing energy sources over the next 30 years, and then went into detail as to how it would allocate those funds in respect of electrical energy, nuclear energy, and so forth, the minister said, simply, "I don't like nuclear energy." I do not know whether that was the minister's real reaction, but that is what was reported. There is no background as to why he does not like it, if in fact he doesn't.

No objective report setting forth the ABCs of nuclear energy has appeared before the public, and the society would like to prepare such a report. I am not now referring to a technical report. There have been many such reports couched in language suitable for the engineer or scientist; rather, I am referring to a public-oriented document setting out the facts of nuclear energy.

**Senator Godfrey:** You want to compete with the *New York Times*. The *New York Times* has published a series of articles relating to plutonium, and so forth.

**Dr. Kerwin:** There is a great need in this country for scientific writing of the calibre of that of the *New York Times*. It is a long-range project of the society to eventually be in a financial position to set up a science news bureau which would disseminate scientific news of an objective nature, but written in such a way that it would be readily accessible and understood by the public. We are eager to get on with that job and have submitted to the various governmental ministries and services—and these are also available to such industries as are interested—33 such projects on which we are ready to undertake studies.

**Senator Buckwold:** Is one of those projects the question of nuclear energy?

**Dr. Kerwin:** Yes, it is.

**Senator Buckwold:** I hope you pursue that.



Mr. Chairman, tha concludes my questioning. I am sure other members of the committee have questions they wish to put to these witnesses.

**Dr. Lewis:** I wonder, Mr. Chairman, if I might add a word or two on nuclear energy, since it is very much my specialty. I am rather afraid that the emotionalism has really got ahead of the powers of the Royal Society to pull it together. There are many activities, and communication is one of the most important.

If it does not drown you with literature, I should like to leave with you a publication entitled, "Questions and Answers—Nuclear Power and the Environment." This is a publication prepared by the American Nuclear Society, which is a professional society, of which I was once president. I was president in 1961 and in 1962. I have read this publication and can vouch for its being good stuff.

**Senator Buckwold:** Wouldn't you say that is suspect?

**Dr. Lewis:** This, of course, is where the emotionalism enters into it. As soon as anyone, myself in particular, speaks about nuclear energy, the first reaction is to determine that individual's background.

I was introduced to radioactivity, which is one of the aspects of nuclear energy, in 1930, which is a long time before the bomb. The people who are scared of nuclear energy have come into the field since the bomb. Because of the bomb and the immediate cloud of secrecy on all of the work that went on at that time, it is difficult to unscare people. They are scared because of the bomb, and to unscare them is an operation for which there is no recipe. I should like to ask our sociologist friend for a recipe to unscare people. It is very difficult. All I can say is that we have to try every means of communication, and particular effort should be directed at teachers passing on information that they received at the height of secrecy, which really is not accurate information at all.

**The Chairman:** In our discussions yesterday, we suggested that perhaps the Atomic Energy Control Board should expand its mission into that field. Any literature coming from Atomic Energy of Canada Limited, of course, is immediately suspect. If the Atomic Energy Control Board would expand its role in this field and contract out some of that responsibility to the Royal Society, it would be a very good development. What we as parliamentarians want to get, and I am sure what the public wants, is both sides of the coin.

**Dr. Kerwin:** I should say, Mr. Chairman, that the Royal Society of Canada has no axe to grind in respect of nuclear energy. We would like also to place before the public, as necessary, the facts concerning solar energy, geothermal energy, and so forth.

**Senator Godfrey:** We had some very dogmatic, reassuring, I would say, statements from the people from AECL yesterday on the question of plutonium, which rather contradicted the articles which appeared in the *New York Times*. I think it is really up to the press, if I might say so, to counter some of the less scientific articles which have been reproduced from the *New York Times* in the local Canadian papers. I was told this morning that the only report of our proceedings yesterday was something to do with French and bilingualism in research. It had nothing to do with the fact that we heard that Margaret Meade was not really scientifically qualified to comment on the dangers of plutonium. That, to me, was a very well worthwhile

story which the public would be interested in. I have not seen the *Globe and Mail* this morning or the Canadian Press reports, and so I am only repeating second-hand information.

**The Chairman:** What we are really saying in other words, Dr. Lewis, is that if as former vice-president in charge of science at AECL you say nuclear power is safe it is almost like our saying that politicians are all honest. You understand there is a credibility gap there.

**Dr. Hurst:** Mr. Chairman, as past president of the Atomic Energy Control Board I was very pleased to hear the chairman speak of it in this way, as having the image that I feel it always should have and that we certainly should try to be promoting to give the public the information. But I think the Royal Society has a role to play, in coordination with the Board, in providing a group of people who are quite outside this field to come forward with a matter which would be of use in the field of public education. It is public education and information which is needed and not brainwashing or deception.

**The Chairman:** What we really need is a good clearing-house, because I am sure that on the side of the optimists people are not too responsible and on the side of the pessimists there are a greater number of people who do not know what they are talking about.

**Senator Buckwold:** I think there is a very significant role to be played in this and in a wide variety of other subjects by a highly respected group such as the Royal Society which has no axe to grind and which could act as the kind of clearinghouse you mentioned.

**Dr. Kerwin:** Mr. Chairman, our symposium and the resulting book on mercury received great publicity, but one that has attracted much less attention, and I do not know why, was our work on the disposal of nuclear wastes. The disposal of nuclear wastes is a subject that comes up every once in a while, and one of the problems with the Society is that they have been led to believe that there may be a method of disposing of nuclear wastes or maybe there is no method. What the symposium brought out is the fact that there are many methods of disposing of nuclear wastes and that which one you use depends on the country—it depends on its economy, its geography, its geology—and you have to suit the solution to the national context, and with each of these methods there is associated a certain guarantee and a certain risk, and each country has to make its own study of its own problem. Nobody in London is going to come up with a solution which is suitable for Paris, Washington or Moscow. These facts were brought out, without any judgment to say that this is better or that that is better. The report of the symposium is available and it is to be hoped it will be used to inform the public about the nature of Canada's specific problems.

**The Chairman:** Would you say that there is a great gap between our scientific knowledge about these issues and what the public knows, and that there is a great role for the media to play in this area?

**Dr. Kerwin:** Well, you are hitting one of the few bright spots in the picture that has developed over the past few years. This is the development in Canada over, say, five years of a group of specialized and, as far as we can see, objective science writers. There used to be three or four and now there are about 20 who contribute regularly to various journals in Canada as well as to *Science Forum*.

**The Chairman:** I understand one is going on strike at 4 o'clock!

**Dr. Kerwin:** I see. Well, as I say, this is a bright spot. And, as I say, we are very pleased about this development, and the Society would like to further it if possible in due course by being able to set up a science news bureau where facts can be obtained rather than the interpretation of facts. This would be useful to this group of science writers as well as to others.

**Senator Buckwold:** Would that not be a role for the Science Council?

**Dr. Kerwin:** I do not believe that the Science Council is supposed to set up services. But whoever sets it up, it is a needed thing.

**The Chairman:** I think the main mission of the Science Council is to advise the government on science policy, and this is something else again.

**Senator Godfrey:** Going back to your third specific recommendation you say it "concerns the efficiency of research in areas of concern to major national goals. The Society recommends that several such goals be specified and that a number of laboratories or centres be designated or created corresponding to them..." and so on. Do you think those laboratories should be created in industry, or should they be government laboratories or university laboratories? And that brings us to this whole question of "make or buy" for national goals.

**Dr. Kerwin:** For the moment we believe that you should take and designate the laboratory that is best suited for the job. If it is a question of management of the continental shelf, where a lot of spotty work is being done around the country in various places, there is an obvious need for coordination, and possibly the coordinating lab to be so designated should be the Bedford Institute, which is a going concern. If it is a question of communications, then possibly the industrial lab at Northern Electric should be so designated. It should be given a contract to coordinate the others. But it is the coordination and efficiency that is necessary in the short term. We are making these recommendations in the context of what we call the present crisis, where we need to have as much efficiency as possible to keep the scientific community going and to have a focus for research so that people will become more enthusiastic when they realize that the country is going somewhere in this field or in that field.

**The Chairman:** Without neglecting the aspect of fundamental research, do you think that there has been an evolution since 1968 and 1969, when we had our first series of hearings, in the reaction of scientists and researchers in the universities? Are they more willing now than they were at that time—at least, this was my impression—to fit into a national program? That is instead of insisting on looking at their own thing individually.

**Dr. Lewis:** I would like to suggest that we should look very closely at a time scale. One of the great difficulties has been that the available positions, style of work and so on, have changed very rapidly, much more rapidly than the universities in their courses will cope with. But, then again, the university does not regard itself primarily as a training school for jobs; it is training the mind to think.

**Senator Godfrey:** You mean, even in the scientific faculties?

**Dr. Lewis:** Yes, certainly. The universities have produced these people who suggest that they would be most happy if nobody wanted their work.

**The Chairman:** But there is always this kind of difference when a scientist wants to pursue his own thing and we are about to launch all kinds of great national R&D programs in the field of oceanography or energy or things of that kind. So I was wondering if there was less reluctance on the part of some university people to fit in with those programs which have national relevance.

**Dr. Lewis:** But that reluctance is very easy to overcome when you show some enthusiasm. When someone enthusiastically wants something, then reluctance changes. If I might take a moment to quote my own life's history, I came through Cambridge in 1930. In 1929 they asked me what I wanted to do when I graduated, and I said I wanted to do research in physics, in anything other than radioactivity. Two months later Rutherford called me to his office and said, "They tell me you understand about wireless valves and we are going to use them in our Alpha ray group. If you get through the exams all right, I would like you to join my group." Well, you don't say no to that. This was the beginning of the depression, 1930, and the man who had been looking after the radium found himself a nice job in the science museum, and there was I, six months later, looking after the radium. My introduction was abrupt. Rutherford said, "Crowe, come over here and show Lewis your hands." Crowe was his assistant and he had permanent lesions on his hands from the doctors trying to remedy these radium burns. "We don't want you to get like that," said Rutherford to me, "so you must be more careful." Of course I was more careful. But being a scientist this was fair enough; that is to say, I knew what I was doing and I knew what had to be done. So, as I say, people's ideas can be very quickly changed with a spot of enthusiasm. My ideas were changed again in 1939, and again by enthusiasm, when it was quite obvious that we had to have radar, and there was I with the Air Ministry on radar. So that is what happened. I would have been perfectly happy working on the cyclotron at Cambridge, but these things do happen.

**Dr. Kerwin:** Mr. Chairman, I must defer to the president of the Academy of Science, but I would also add that in my opinion, resulting from discussions with my colleagues, the fundamental scientists today are no less reluctant than they were at the beginning of your study to put their energies and efforts into applied or mission-oriented research with socio-economic goals. They agree that the knowledge that they generate should be so applied; they are willing to take part in it on an *ad hoc* basis and to train students for doing it, but I would say that as a group they are opposed to any diminishing of the fundamental pure non-oriented, curiosity inspired research. They would be just as enthusiastic now as they were then for the suggestion that their potential be channelled to immediately useful goals. But what has happened in the interval is that there has been a reduction of over-all support everywhere. Moneys have been a little more readily available for applied work, and so in almost every university you now have teams working on projects which ostensibly and in many cases in fact have a short-term goal. Therefore the profile of the work pattern has changed, but I do not think that the reluctance on the part of the pure scientist has changed at all.

**The Chairman:** Well, I am sorry to disagree, but if my memory serves me well I remember that one of the themes



when we were having our first inquiry was, "Give us the money and let us do the job." I remember a professor from Queen's at that time—and I think he was in physics or chemistry—telling us that this was the kind of theme, more or less, that was developed at that time, and that is why we referred at some stage in volume 1 to what we call the "republic of science." We never had in mind the intention of undermining fundamental research, but it would perhaps be more useful if some of these people would agree to direct their fundamental research to areas which have more relevance to our current problems, assuming, of course, that results can come ten or twenty years from now.

**Dr. Kerwin:** To give an example, about eight or ten years ago there were biomedical scientists in Canada interested in carrying out fundamental research on the causes of tropical diseases. This was of absolutely no interest to Canada, but don't we wish now that they had been doing it, in 1976 when lassa fever appears to be cropping up in Ontario, swine flu and so on. At the time it was of no interest to Canada, but it is an example of the fact that it would have been a scientific base available to meet current crises, and would justify the maintenance of research in fields of no interest to us, and which would never be of interest to us. Once in a while in a socio-economic plan it becomes useful, and even vital.

I believe that L'Institut Frappier in Montreal asked for about \$100,000 two or three years ago because they wanted to tool up for swine flu. This was then of no interest to Canada and they did not get it. I think they are willing to spend millions now to combat swine flu.

**The Chairman:** And waste money probably.

**Senator Bell:** Can we hear some more of the 33 projects? Could you give us a few more that you had proposed?

**Dr. Kerwin:** I would defer to Dr. Hurst, who is the Executive Director of the Society, responsible for this particular project.

**Dr. D. G. Hurst, Executive Director, The Royal Society of Canada:** These titles are as follows:

1. Factors affecting scholarly activities in Canada.
2. Shifts in the balance of resource endowments in Canada and the implication of such shifts and prospective shifts for the economic and political structure of the country.
3. The impact of science and technology on Canadian culture.
4. Uses of artificial satellites.

Here we are thinking specifically of looking at the assessment of experiments to be done with the Communications Technology Satellite.

5. Public education on food, nutrition and health.

Here I might interject to say that I have a paragraph describing each of these, if any of them is of particular interest.

6. Ecological agriculture.
7. The systems approach to food production.
8. The problems of food production.
9. Public education on nuclear energy.
10. The cultural, social and ethical implications of nuclear energy.

11. Population policy and the energy crisis.
  12. Adequacy and potential of Canadian institutions for conversion to a conserver society.
  13. Chemical additives in food.
  14. An analysis of the influence and assessment of the findings and recommendations of specific Royal Commissions.
  15. The conflict between the right to privacy and the data storage necessary in a complex society.
  16. Causes and consequences of location of intellectual creative work.
  17. Urbanism, problems of solitude, et cetera.
- Canadian French-English dictionary.

**The Chairman:** You will have another headline in the *Globe and Mail* tomorrow.

**Dr. Hurst:** The list continues:

19. Criteria for selecting heritage items to be preserved.
20. Needs for and availability of academically and technically trained manpower.
21. Highly specialized manpower needs.
22. An assessment of research findings on the economic and social cost of alcoholism and other forms of drug dependence.
23. Transportation in Canada, its effect on society, its financing, et cetera.
24. Changing dimensions of crime, violence and terrorism.
25. Stratospheric pollution, especially the effect on the ozone layer.
26. Effects of atmospheric pollution (medical, social, agricultural, economic).

Here there is a distinction between one, which is the stratospheric pollution, and the second one, which is atmospheric pollution.

27. Evaluation of energy conservation measures and energy budgets.
28. Medical, legal, economic, social, human and philosophical problems arising from recent developments in biology.
29. Ethical implications of future problems foreseen in such studies as "Limits to Growth".
30. New dimensions of the welfare problem.
31. An assessment of Canadian immigration policy.
32. Background investigations for support of Canadian studies abroad.
33. An assessment of present methods of scientific and technological communication in Canada.

**Senator Bell:** You cannot get much broader than that.

**The Chairman:** We will have to conclude this meeting fairly soon. I think the discussion today has ranged over and can be divided into three main categories. We are here, Mr. President, especially to hear grievances. The first category of problem is the role of the Royal Society in international relations at the private level. I understand that you are relatively satisfied with the progress that has been made in defining a role, as opposed to government agencies.

**Dr. Kerwin:** I would not say we are satisfied.

**The Chairman:** There is no solution yet.

**Dr. Kerwin:** We are reporting that we have been working hard on it, and the light is now seen at the end of the tunnel.

**The Chairman:** Could you specify some of the difficulties that remain? Are they with the government or with individual societies?

**Dr. Kerwin:** We first have to obtain from a good number of societies their agreement to co-operate with the Society in setting up the national committees for these disciplines. As I say, the replies we have had so far are favourable. Once we have obtained all of these replies, assuming they will all, by and large, be favourable, we must then, in the light of this, present to the government—we are not sure if it should be MOSST or some other agency; presumably MOSST—the proposal or contract plan evolving from this latest of a series of schemes that we have put forward. The question then is to convince the government and the National Research Council that this is a workable scheme. We have been through several rounds of this and we think we now have a plan which is operable, and which will be acceptable to everyone.

**Dr. Clark:** I might add that the Institute of Engineering (I think it is called) got up on its hind legs to indicate very clearly that it did not want to be a party to this operation. Also, there were strong indications from the humanities and social sciences side that they would not welcome the intervention of the Royal Society. The Royal Society has, as of now, made no effort to undertake any sort of activity in the area of the humanities.

**The Chairman:** If we could have a start, even if it does not include all the different societies, we would at least have a nucleus.

**Dr. Kerwin:** We are concentrating on the pure sciences, but we believe we could be useful to the engineering community. Several of their very distinguished people are Fellows of the Society and appear to obtain profit, and possibly solace, from the meetings and contact they have with other disciplines.

**The Chairman:** You will be preparing a report. I hope this report will be confidential and that we will get a copy of it.

**Dr. Kerwin:** You will be kept abreast of our efforts.

**The Chairman:** We do not get all the reports that are available to the public.

**Dr. Kerwin:** We will make sure it is confidential.

**The Chairman:** The other thing is the role of the Royal Society to the national level. This has to do with contracting out from the Science Council, MOSST and things like that, and possibly other agencies that have been mentioned this afternoon, such as the Atomic Energy Control Board. Are you satisfied with the present situation or with the progress you are making?

**Dr. Kerwin:** This is one role of the Society, which it has played by and large over the years on another scale. The Society is Canada's national academy, and therefore plays all of the aspects of the role that this implies. That we should be able to undertake on a larger scale specialized studies would be very gratifying, and the difference between now and ten years ago, when we were making a few such studies, is that there is now a greater awareness by the public of the need for this, and a greater sensitivity on the part of governments to supply the public with objective information. We are uniquely suited to fulfil this role.

**The Chairman:** You are making reports to different government organizations to be able to expand that role, are you?

**Dr. Kerwin:** That is right. These 33 proposals have, as a first lot, been distributed to over 40 ministries, divisions, services and crown companies.

**The Chairman:** Could we have the list?

**Dr. Kerwin:** Certainly.

**The Chairman:** I think the last area of issues which have been raised this afternoon has to do with the level of support for research and development in universities and other areas. I must say that I do not have any additional questions on this. We appreciate your representation in this field, but I must say that you have not been too original, in the sense that you have joined the group.

**Dr. Kerwin:** Join the chorus.

**The Chairman:** Yes.

**Senator Bell:** But very strongly.

**The Chairman:** Yes, very strongly.

**Senator Bell:** Very outspoken.

**The Chairman:** I want to thank you very much for this presentation. Now you have left us with both worries and hope, and I hope that we will continue to be optimists.

[Translation]

**Dr. Kerwin:** Thank you very much, Mr. Chairman.

**The Chairman:** My thanks to you, too.

The committee adjourned.

## Appendix "35"

THE ROYAL SOCIETY OF CANADA

LA SOCIÉTÉ ROYALE DU CANADA

February 13, 1976

Senator the Honourable Maurice Lamontagne, F.R.S.C.,

The Senate,

Parliament Buildings,

Ottawa, Ontario

Science Policy

Dear Senator,

As President of the Royal Society of Canada, I am replying to your letter of 14 October 1975, addressed to my predecessor Dr. Claude Fortier, regarding the forthcoming activities of the Senate Special Committee on Science Policy.

In 1969, the Society presented a brief to your Committee giving information about the Society and containing recommendations that are still valid. More recently we have sent to you "A Response to Volume 3 of the Report of the Senate Special Committee on Science Policy". A copy is enclosed together with a brief summary of the activities and interests of the Society related to Volume 3.

The principal point of this letter is to bring to your attention the seriousness of the contemporary predicament of Canadian science. During the time since the Society presented its brief to your committee in 1969, political and economic climates in Canada have become much less favourable for science and technology. There has, for example, been a steady erosion of support for research in universities: between 1969-70 and 1975-76, funds available to the National Research Council for grants and scholarships increased by only 22% in current dollars while the consumer price index increased by 53% and the gross national product increased by 97%. There has not been any substantial increase in the level of science and technology practised in Canadian industry that might offset the decrease in the university sector. Except for some expansion related to applications of technology to the environment, effective funding of science and technology in government laboratories has also decreased.

The Medical Research Council is the major source of support for biomedical research in Canada, and particularly for basic research in universities. Whereas other developed countries assign ¾% of their health care budget for research, federal support of the M.R.C. has declined from 1.33% of the total budget of Health and Welfare in 1971-72 to 0.85% in 1974-75. Support for medical research in Canada from all sources has fallen from 1.5% of health care expenditures in 1969-70 to less than 1.0% in 1975-76.

The Society is greatly concerned about the serious decline in the support for science and technology and urges your committee to examine the changes that have occurred and their long-term consequences. Unless the decline of support for science and technology is reversed, Canada will become ever more dependent on expertise from other countries and will have to contend with erosion of our high-technology markets, our standard of living and our sovereignty.

We shall be glad to cooperate in seeking ways to make science more effective in Canada. We are continuing our studies of this important matter and will be pleased to send to you copies of our future deliberations.

Yours sincerely,

S. D. Clark,  
President.



## Annex I

THE ROYAL SOCIETY OF CANADA  
LA SOCIÉTÉ ROYALE DU CANADA  
395 WELLINGTON, OTTAWA, ONTARIO, K1A 0N4

Response to

THE ROYAL SOCIETY OF CANADA

to

*A Science Policy for Canada: Report of the  
Senate Special Committee on Science Policy:  
Vol. 3: "A Government Organization for the  
Seventies"*

Approved by Council

6 February 1974

*Summary*

The Senate Special Committee on Science Policy recommends that "the Royal Society, with the assistance of a special grant from the Ministry of State for Science and Technology, assume the overall responsibility for developing and maintaining relations with foreign private scientific and engineering bodies, in close cooperation with the International Branch of the Ministry and the specialized scientific and engineering associations existing in Canada." The assumption is that the Royal Society of Canada will perform this role as a part of its function as a private national academy. (The relevant recommendations of the Committee are given in full in Appendix I.)

Agreeing that this is a proper role for it to play, the Royal Society makes its acceptance contingent only upon the transfer to the Society of the necessary funds, preferably as recommended, i.e. "an adequate, annual, unconditional grant".

*Royal Society Recommendations*

The Royal Society of Canada recommends the following:

1. That the Government of Canada concur with the Senate Special Committee's recommendation that the Royal Society assume overall responsibility for relations between Canada and international scholarly bodies.
2. That the Government approve the principle of an "annual, adequate, unconditional grant" to the Royal Society to cover the necessary fees, travelling expenses and administrative support for these activities. At this time the total sum required is estimated at about \$1m. per year.
3. That the Government make an initial grant to the Royal Society adequate in amount for it to begin these international activities and to hire the necessary staff who, under an experienced officer, would work out details of the transfer of responsibility and the expanded role of the Society.

*Background*

Ever since the Renaissance the scholars of any given country, both individually and collectively, have published books and papers and have corresponded freely with their counterparts in other countries. In the most developed nations this dialogue has long been carried on with the aid of national



academies. Such is clearly the case with the Royal Society of London, which has maintained a Foreign Office over a period of centuries.

Dialogue between and through academies is an invaluable means of international communication in the sciences and humanities. It has particular value at times when conflicts threaten to close other avenues of communication. Today it offers special advantages in dealings with Socialist countries; for here it can attain objectives and secure action, which could not be achieved through the formal channels of government. Canada, through her neglect of international academic relations, has hitherto not taken advantage of this obvious means of communication. The Royal Society is, however, currently establishing itself in the international fraternity of academies and believes that this role should now be enlarged.

The Royal Society is unique in Canada in possessing the qualities that fit it for the function proposed by the Senate Committee. Unlike other established bodies it embraces all scholarly disciplines; thus it is comprehensive and interdisciplinary at a time when the interdependence of knowledge is becoming increasingly recognized. Moreover, as a body whose members are elected by their peers, it is disinterested and unaffected by pressures applied by the special interests of any particular time or situation.

Canada is presently the only western adherent to international non-governmental organizations (NGO's)—e.g. the International Council of Scientific Unions (ICSU)—which communicates through government agencies rather than a national academy. Normally such communication is conducted between academies, and it is thus anomalous for the Canadian government to communicate with a foreign academy. Canada should follow suit in order to present a better face and remove a source of international embarrassment.

In carrying out this function of communication the academies of most western countries are supported by public funds. Canada stands out as one of the few not supporting a national academy that relieves government of this function. For example, the United Kingdom parliament currently appropriates £1m. annually to the Royal Society of London, of which some £400,000 is designated for international scientific activities. It also grants some £500,000 to the British Academy. Similarly the United States government grants about \$3.5m. to the National Academy of Sciences for international scientific activities, including \$750,000 for the Foreign Secretary's office. The French government gives generous funding to the Institut de France, and the Belgian government affords similar support to its Académie royale des sciences, des lettres et des beaux-arts. Among non-European nations, Australia makes a substantial annual grant to its Academy of Science.

### *The Society's Foreign Programme*

For the more effective carrying out of its international programme the Royal Society of Canada now has a standing Committee on International Relations. This body advises the Society council on international matters, corresponds with foreign academies, and administers the foreign programme. When appropriate, its Chairman consults with the Department of External Affairs of the Canadian government.

The Royal Society has had long association with government. The early growth of scholarship in Canada, particularly in the natural sciences, was largely sparked by such government agencies as the Geological Survey, the National Research Council and the ministries concerned with agriculture, fisheries and mineral resources. At the same time the graduate faculties of the universities grew very slowly until after the First World War. As a result of these conditions and of the difficulties of communication in a vast country, officers of government exercised a considerable influence in the Society. These were understandably slow to recommend an independent role for the Society and content to leave international affairs to the government. Today, however, the academic community is strong, scholars more numerous outside the federal public service than within, and national communications vastly improved. Thus at last the Royal Society is in a position to fulfil the promise at its creation by Parliament ninety years ago as a true national academy.

The Society's foreign programme is now undergoing rapid development. The Chairman of its International Relations Committee has been named its representative on the National Research Council's Committee on International Scientific and Technological Associations; and this ensures an

effective liaison between the two bodies. The Society has also taken the forward step of acting for Canada on the International Foundation for Science (IFS); and the International Research and Development Centre has indicated that it will welcome its cooperation. A proposal has been made to the Minister of State for Science and Technology whereby the Society would act as adhering body to the new International Institute for Applied Systems Analyses (IIASA). Action of this kind is also pending in regard to a number of other international NGO's, which the Society feels might better be adhered to by a Canadian NGO rather than a government agency.

### *The Society's National Role*

In recent years the Royal Society has correspondingly increased its domestic activities beyond its regular meetings and publications. A new series of symposia has dealt with such topics of concern to public and government alike as mercury pollution and energy resources, to name but two. In addition, the Society now has an active committee on science policy; has established formal liaison with MOSST and SCITEC; and is developing links with the Social Science Research Council and the Humanities Research Council. Its awards in recognition of outstanding scholarship are highly prized throughout the country. Finally, it has created new divisions within the Society for scholars in fields of engineering and medicine in order that the representation of all the sciences, pure and applied, shall be complete.

### *A Survey of Canada's Present Position in relation to International NGO's*

The Royal Society has recently made a survey of how Canada is presently represented on international NGO's. The three granting councils, the National Research Council (NRC), Medical Research Council (MRC) and Canada Council, along with several departments of government, currently provide the funds for these activities. Of these, NRC, with its administrative group of about eight and total budget of some \$0.5m. a year, has the largest and most effective organization for the administration of this function.

Attention in our survey was concentrated on Canadian representation on the five main international "umbrella" organizations:

1. International Council for Philosophy and Humanistic Studies (CIPSH)
2. International Social Science Council (ISSC)
3. International Council of Scientific Unions (ICSU)
4. Council for International Organizations for Medical Sciences (CIOMS)
5. Union of International Engineering Organizations (UIEO)

Annual dues are paid by Canada to these international NGO's or their constituent bodies, thus signifying Canadian adherence to them. These fees augment their financial support derived from UNESCO and other sources. Meetings for administrative or scholarly purposes are held at intervals of from one to three years. The travelling expenses of the Canadian scholars in attendance are usually paid directly or indirectly by one or other of the three granting councils and in some cases by a government department.

A summary of the findings is shown in Appendix II.

### *Discussion of the Survey*

The survey shows the situation in the natural sciences to be very different from that in the social sciences and humanities.

In the natural sciences, NRC plays the leading role. It is, for example, the adhering body to ICSU and most of the latter's constituent unions. The only union not adhered to by a government agency is the International Mathematical Union; here the adhering body is the Canadian Mathematical Congress. As is well known, ICSU and its unions and committees have played a major part in promoting international science. The International Geophysical Year of 1957-8, which gave birth to artificial earth satellites and brought the world into the space age, was organized by ICSU. Another of its major initiatives has been the Global Atmospheric Research Programme (GARP).

In the humanities and social sciences, however, adherence is normally through individual Canadian disciplinary societies. These are represented on international umbrella bodies by international discipli-



nary bodies. Canadian participation in international scholarly gatherings is here funded by direct travel grants from the granting councils to participants in a specific programme. But there is no policy of support for Canadian representation, except perhaps for those Canadians who are officers of international bodies.

Because of this situation, and because of the already established roles of the Humanities Research Council of Canada and the Social Sciences Research Council, the Royal Society's international role in the humanities and social sciences would at least initially be less direct than in the natural sciences. Nevertheless there would be definite places both for the Society and for the Councils and their constituent societies, as support policy for activities affecting all disciplines evolves.

International NGO's act as technical advisers to UNESCO and to the Economic and Social Council of the United Nations. For this reason UNESCO provides financial support designed to augment the fees paid by national adhering bodies.

### *Proposed International Role for the Royal Society*

If the Government accepts the Senate Committee's recommendations, the Royal Society will establish an international office headed by a senior officer. This office, which should have adequate support staff, would, under the general direction of the International Relations Committee be responsible for liaison with the Department of External Affairs on all appropriate matters. It would also notify international NGO's of the visits of Canadian scholars to international NGO's and of those of foreign scholars to Canada under similar auspices; sponsor, or advise on the holding of, international assemblies and other meetings in Canada; and organize and generally administer the Royal Society's involvement in international relations.

The Society would undertake, in cooperation with the appropriate Canadian professional and learned societies, the naming of competent delegates to international NGO's and their constituent bodies. Where necessary it would conduct the briefing of, and reporting by, those delegates and administer the funds for travelling expenses. The Society would also ensure adequate representation of Canadian scholars abroad, as well as appropriate assistance to, and adequate participation in, international projects.

The preferred method of supporting these activities is through an "unconditional" grant to the Society, the amount to be negotiated annually. The Society is unable at the present moment to give a precise estimate of its needs, but the amount will be of the order of \$1m. a year if all activities presently handled by Government are to be transferred to the Society. Most if not all these funds are of course already included in the estimates of the various departments and agencies. The grant to the Society's foreign programme would of course be over and above the grants now being made in support of the Society's national activities.

A detailed plan for a phased take-over of international activities (if approved by the Government), the striking of a budget, and methods of granting funds are among the matters still to be discussed with government agencies. The Society would also need funds for this additional administrative burden. In this connection an initial grant of \$150,000 would be needed for the establishing of proper procedures. This amount would increase to the greater figure mentioned above over a period of three or four years, as responsibilities were progressively transferred. The process would be greatly eased if the Government were to attach an experienced officer to the Society.

### *Alternative Courses of Action Open to the Government*

#### *1. To maintain the status quo*

The main advantage of this course, in so far as it concerned natural sciences and engineering, would be its possible administrative convenience. For NRC quite efficiently administers Canada's relations to international NGO's in the natural sciences and maintains very good liaison with the Department of External Affairs. But the disadvantages are considerable. The possibility of conflict always exists in areas where provincial governments seek involvement. There is also a potential for embarrassment to foreign scientists and scholars in their having to deal with government agencies rather than private bodies, and conversely, to the Canadian government in its dealings with private international bodies.

Finally, our present procedures are undoubtedly blocking some channels of communication between our scientists and scholars and those of other countries and are inhibiting Canadian participation in some international projects.

*2. To give the Royal Society overall responsibility for relations with international NGO's*

The advantages of this course are consistency with the practice of most other nations; an improved image for Canada internationally; the effecting of economies through avoidance of duplication; the establishment of a single point of contact with the Department of External Affairs in respect to international NGO's; and the improvement of international channels of communication whereby Canada can better achieve certain objectives outside government channels. Informal discussion with some officials indicates a preference for this course.

The only disadvantage here would lie in the minor dislocations and temporary changes in some government agencies resulting from the transfer of funds to the Royal Society. This could be minimized by making the transfer at an orderly rate rather than all at once.

*Royal Society Recommendations*

The Royal Society of Canada recommends the following:

1. That the Government of Canada concur with the Senate Special Committee's recommendation that the Royal Society assume overall responsibility for relations between Canada and international scholarly bodies.

2. That the Government approve the principle of an "annual, adequate, unconditional grant" to the Royal Society to cover the necessary fees, travelling expenses and administrative support for these activities. At this time the total sum required is estimated at about \$1m. per year.

3. That the Government make an initial grant to the Royal Society adequate in amount for it to begin these international activities and to hire the necessary staff who, under an experienced officer, would work out details of the transfer of responsibility and the expanded role of the Society.

*Recommendations of the Senate Committee on Science Policy*

Two recommendations of the Senate Committee mention the Royal Society of Canada, namely—

12....The Committee therefore recommends that the Royal Society of Canada, with the assistance of a special grant from the Ministry of State for Science and Technology, assume the overall responsibility for developing and maintaining relations with foreign private scientific and engineering bodies, operating at the international (or national) level, in close cooperation with the International Branch of the Ministry and the specialized scientific and engineering associations existing in Canada.

The Committee therefore recommends:

17. (1)...That the Ministry of State for Science and Technology be mainly responsible for defining and coordinating the Canadian government's relations with private scientific and engineering societies, that the present activities carried out by NRC, the Canada Council, and similar agencies in the area of relations with such private bodies at the national and international level be phased out and that the funds allocated by these government agencies for this purpose be transferred to MOSST;

(2)...the Ministry formally recognize the Royal Society of Canada and the Association of the Scientific, Engineering and Technological Community of Canada (SCITEC) as the two main spokesmen of the Canadian scientific and engineering community in the areas of science for policy and policy for science respectively;

(3)...the new "make-or-buy" policy be applied in these two areas by all government departments and agencies, especially by MOSST and the Science Council, and that studies they require on these two topics be contracted out whenever desirable to the Royal Society and SCITEC;

(4)...The Ministry of State for Science and Technology make an adequate, annual, unconditional grant to these two national bodies—the amount to be determined after consultation with them—



for the purpose of enabling them to maintain an efficient secretariat, to undertake a few studies on their own initiative, to hold periodic symposia, and to finance their publications;

(5) That these arrangements be for the 1970s and be evaluated for review in 1980.

## ANNEX II

to letter to Senator

Lamontagne

dated 13 February 1976

The Royal Society of Canada

La Société Royale Du Canada

SOME RECENT ACTIVITIES OF THE ROYAL SOCIETY OF CANADA*1. International Relations*

(a) The Society was among the early supporters of the International Foundation for Science which supports research workers in developing countries in fields directly related to the needs of these countries. It is the Canadian adhering body to the Foundation.

(b) It organized a meeting on January 30th 1976 with presidents of scientific societies to discuss the future organization of Canadian adherence to non-governmental international scientific organizations.

*2. Symposia*

The Society has organized symposia on topics of current interest, a list of which is appended. The proceedings of these symposia have been published or are in press.

*3. Services to the Country*

The Society is assessing, under contract with the Ministry of State for Science and Technology through the Department of Supply and Services, how it can further serve the interests of the country and in particular the needs of the Government of Canada.

## ANNEX II

The Royal Society of Canada  
La Société Royale du Canada

page 2

SYMPOSIA

Aside from symposia held during annual meetings of the Society, the following symposia have been organized:

Mercury in Man's Environment	(1971)
Communications into the Home	(1972)
Physics and Chemistry of Ice	(1972)
Energy Resources	(1973)
Copernicus	(1974)
Waster Re-cycling and the Environment	(1974)
Amérindiens	(1974)
Perspectives in Spectroscopy	(1974)
Problems of Atlantic Canada	(1975)
Glacial Till	(1975)
Preserving the Canadian Heritage	(1975)



FIRST SESSION—THIRTIETH PARLIAMENT

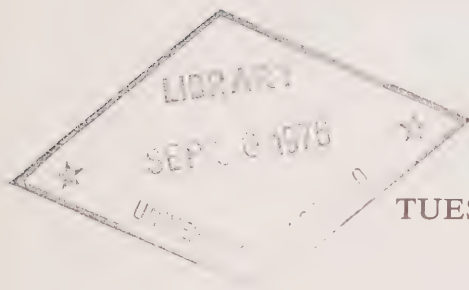
1974-75-76

# THE SENATE OF CANADA

PROCEEDINGS OF THE  
SPECIAL COMMITTEE OF THE SENATE ON

# SCIENCE POLICY

The Honourable MAURICE LAMONTAGNE, P.C., *Chairman*



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Issue No. 21

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TUESDAY, SEPTEMBER 7, 1976

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**Twenty-first Proceedings on**  
the Study of Canadian Government and  
other expenditures on scientific activities  
and matters related thereto.

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(Witnesses and appendices: See Minutes of Proceedings)



THE SPECIAL COMMITTEE OF THE  
SENATE ON SCIENCE POLICY

The Honourable Maurice Lamontagne, P.C.,  
*Chairman*

The Honourable Donald Cameron, *Deputy Chairman*

and

The Honourable Senators:

Asselin	Hastings
Bélisle	Hicks
Bell	Lang
Blois	Manning
Bonnell	Neiman
Bourget	Riel
Buckwold	Robichaud
Carter	Rowe
Giguère	Stanbury
Godfrey	Thompson
Goldenberg	van Roggen
Grosart	Yuzyk
Haig	

27 Members

(Quorum 5)

# Order of Reference

Extract from the First Report of the Special Committee of the Senate on Science Policy, presented on July 10, 1975 and printed as an Appendix to the Minutes of the Proceedings of the Senate of that day, and adopted by the Senate on July 24, 1975:

"The Committee, therefore, recommends that it be authorized to consider and report on Canadian government and other expenditures on scientific activities and matters related thereto;

That the Committee have power to engage the services of such counsel and clerical personnel as may be necessary for the purpose of the inquiry;

That the Committee have power to send for persons, papers and records, to sit during adjournments of the Senate and to report from time to time; and

That the Committee be authorized to print such papers and evidence from day to day as may be ordered by the Committee."

Robert Fortier,  
*Clerk of the Senate.*

# Minutes of Proceedings

Tuesday, September 7, 1976.  
(35)

Pursuant to adjournment and notice the Special Committee of the Senate on Science Policy met this day at 9:35 a.m., the Chairman, the Honourable Senator Lamontagne, presiding.

*Present:* The Honourable Senators Bell, Carter, Godfrey, Hicks, Lamontagne, Lang, Stanbury and Yuzyk. (8)

*In attendance:* Mr. Phillip J. Pocock, Director of Research and Mr. Jacques W. Ostiguy, Chief of Administration.

The Committee resumed consideration of its Order of Reference dated July 24, 1975 relating to the study of Canadian Government and other expenditures on scientific activities and matters related thereto.

The following witnesses were heard:

*From: The Canadian Council of Professional Engineers:*

Mr. C. J. Moull, President;

Mr. L. M. Nadeau, General Manager;

Mr. L. C. Sentance, Acting Executive Director,  
Association of Professional Engineers of Ontario.

*The Engineering Institute of Canada:*

Mr. Robert F. Shaw, President;

Mr. Byron T. Kerr, General Manager;

Mr. D. L. Mordell, Immediate Past-President.

Mr. Moull and Mr. Shaw both made opening statements. The witnesses then answered questions put to them by Members of the Committee.

On Motion by the Honourable Senator Carter, it was *Agreed* that the joint brief presented to the Committee by The Canadian Council of Professional Engineers and The Engineering Institute of Canada be printed as an appendix to this day's Minutes of Proceedings and Evidence. (See Appendix No. "36")

During the question period, Mr. Moull mentioned the Proceedings and the Recommendations reached by the Ontario Engineering Advisory Council at its Seminar held in Toronto on June 28, 1976. On Motion by the Honourable Senator Yuzyk, it was *Agreed* that both the Proceedings and the Recommendations be circulated to all members of the Committee and that the Recommendations only be printed as an appendix to this day's Minutes of Proceed-

ings and Evidence. (See Appendix No. "37")

At 12:35 p.m. the Committee adjourned until 2:30 p.m., Tuesday, September 7, 1976.

ATTEST:

Patrick Savoie,  
Clerk of the Committee.

# The Special Committee of the Senate on Science Policy

## Evidence

Ottawa, Tuesday, September 7, 1976

The Special Committee of the Senate on Science Policy met this day at 9.35 a.m. to consider Canadian government and other expenditures on scientific activities and matters relating thereto.

**Senator Maurice Lamontagne** (*Chairman*) in the Chair.

**The Chairman:** Honourable senators, we have this morning two very important national associations, the Canadian Council of Professional Engineers and the Engineering Institute of Canada. As you already know, they had agreed to give us a joint presentation, but I understand that they wish this morning to separate in their opening statements and, in other words, to make two opening statements. I will now ask Mr. Moull, President of the Canadian Council of Professional Engineers, to make his opening statement. Before he does that I would invite him to introduce his delegation to us.

**Mr. C.J. Moull, President, Canadian Council of Professional Engineers:** Honourable senators, I should like to introduce the General Manager of the Canadian Council of Professional Engineers, Mr. Leo Nadeau.

**The Chairman:** He is well known to the committee.

**Mr. Moull:** Yes, he is well known. To Mr. Nadeau's right is Mr. Sentance, the Acting Executive Director of the Association of Professional Engineers of Ontario. I might ask Mr. Shaw if he would introduce the counterparts from the Engineering Institute of Canada.

**The Chairman:** Before Mr. Shaw does that, I should point out that Mr. Shaw is the President of the Engineering Institute of Canada and is a former Deputy Minister of the Department of the Environment. Before that I believe he made a certain contribution to Expo 67 in Montreal.

**Mr. Robert F. Shaw, President, Engineering Institute of Canada:** Thank you, Mr. Chairman. Honourable Senators, I should like to introduce Dr. Donald Mordell, Immediate Past President of the Engineering Institute of Canada, and our General Manager, Mr. Byron T. Kerr.

**The Chairman:** Before proceeding any further, I should like to have the usual motion to print the joint brief from the two associations as an appendix to today's proceedings.

**Senator Carter:** I so move.

**Hon. Senators:** Agreed.

(*For text of Appendix see page 27*)

**Mr. Moull:** Mr. Chairman, my colleagues and I are grateful for this opportunity to appear before your Committee to discuss the views and suggestions of the engineering

profession which were submitted in response to the report and request of the Committee.

We would first like to reiterate our real appreciation of the very valuable contribution made by your Committee in attracting the attention of government and the public to the importance of engineering and science in the solution of the great economic and social problems facing this country at this time.

It is not my intention to summarize our written submissions with which you are undoubtedly familiar but I would like to emphasize certain points which we consider to have special importance.

First and foremost, we wish to again emphasize the urgent need to establish clearly identified national goals and priorities, dynamic and flexible targets and strategies and a renewed feeling of mutual respect and confidence between industry and government. We also wish to reiterate our belief that every attempt must be made to build on existing strengths and to ensure that these strengths are not dissipated or eroded—all in preference to replacement by new but untried processes or organizations.

We believe that the failure of the Government to maintain, let alone increase, the allocation of resources to research and development in the natural science and engineering fields in recent years and its recent decision to continue this policy during the current period of restraint are due in large measure to the absence of clear objectives.

We also believe that government must make productivity improvement one of its major national goals and wholeheartedly endorse the recommendation of a recent Ontario Engineering Advisory Council Seminar that the federal government give leadership in this area and promote the establishment of an independent National Centre for Productivity in which representatives of Government, Labour, Management and Engineering can contribute usefully and effectively to the development and inculcation of new philosophies and mechanisms for productivity improvement.

Finally, our profession is deeply concerned with manpower utilization and planning in the field of engineering and technology and has established a Canadian Engineering Manpower Council to carry out studies and surveys in collaboration with governments, industry, universities and other interested parties, in this vital area.

We appreciate recent steps taken by the Government of Canada to promote a better utilization of Canadian engineering capabilities but feel that substantially increased efforts in this direction are necessary if Canada is to maintain and improve its innovative capability.

The make or buy policy promoted by your Committee is also a forward step in this direction but its application



must be greatly expanded in order to achieve appreciable results.

This concludes my opening remarks Mr. Chairman. My colleagues and I will be happy to discuss details of our briefs and to attempt to answer questions.

**The Chairman:** Thank you, Mr. Moull. We will now hear from Mr. Shaw.

**Mr. Shaw:** Mr. Chairman and honourable senators, I should like to echo Mr. Moull's statement of appreciation of the work of this committee, which is so important, and the invitation to be before you. I have distributed copies of my opening statement which may assist you in developing the discussion.

Industrial Canada has become increasingly aware of the rapid deterioration of both productivity and product unit costs relative to the performance of its off shore competitors, notably the United States.

Canadian productivity, by reason of scale and other factors, continues to lag that of the U.S.A. by some 20 per cent. At the same time wages in Canadian secondary industry have now passed the point of parity with the U.S.A. in some instances by as much as 20 per cent.

In the meantime we are working with old tools. Today the average Canadian is working with capital equipment two to three years older than the tools of his competitors in Germany and Japan.

If this crisis in Canadian productivity and costs is left unattended it will lead to a reduction in the Canadian standard of living and in our ability to finance social programs. We have already slipped to ninth in the world in these areas.

Now productivity is intimately related to research and development and in particular to the transfer of technology from lab to field and to factory.

Mr. Chairman, this committee is at the heart of the government's effort to solve these problems.

The engineer stands ready and willing to assist. Although he does research he is more often the developer in the R & D team—the bridge between science and society.

The profession is well organized. "Cooperation" is the key word between engineering organizations from coast to coast. Our relations with engineering bodies beyond Canada's borders are active and effective.

So far the results of our current efforts here in Canada to create more R & D, particularly in industry, have shown only indifferent results.

The total science budget of the Government of Canada in the past six years (70-71 to 75-76) has increased by 69 per cent. The actual gain, however, in constant 1970 dollars is \$76 million or about nine per cent.

During the same period, the share contracted out and given in grants to industry dropped from 18.4 per cent to 13.4 per cent and the share to the universities dropped from 17.1 per cent to 13.9 per cent. Included in the totals is "mission oriented" research and development. Here, industry's share in contracts has increased from 4.4 per cent to 12.9 per cent and the share to universities has increased from 1.0 per cent to 2.0 per cent.

However, during that period the new Department of the Environment was created and major environmental

assessments have been undertaken in such areas as the Great Lakes, the Mackenzie Valley, the Peace-Athabasca Delta, the Okanagan, James Bay and the Beaufort Sea. During the same period the new Ministry of State for Urban Affairs has added its load and other government departments have undertaken new missions in such areas as the use of satellites, and the extraction of oil and gas from the sea bed. Most of this "science" has been the application of known technology. Little of it breaks new ground.

Therefore it can be said that in Canada the amount of normal ongoing government research and development has probably decreased, industry's share has decreased, the university share has decreased, and only on special new types of projects has the "buy" policy worked.

In the meantime, we, in Canada, are living in a period of exploding technology and declining productivity.

What is wrong?

1. In the first place I believe we have been led astray by those OECD tables that show Canada as spending a higher percentage of the science dollar in government and a lower percentage in business enterprise. But Canada is a huge country with a vast, hard to develop "north"—one of the world's largest continental margins—and a resource-based economy.

Even though we are classed as an industrial country we in no way resemble the other nine countries listed. One apple: nine oranges.

The Government of Canada should be, and it has been, pushing back our frontiers where industry cannot yet go. Now it has slowed this effort. We plan to manage a two hundred mile economic zone off our coasts. Some twenty nations fish in those waters and we cannot even find the money to do an environmental assessment of our own most valuable fishing grounds, the Gulf of St. Lawrence, the Straits of Georgia, the Bay of Fundy, and others.

We cannot afford a research-equipped heavy duty ice breaker for our Arctic, and we have added little to our research budget in the two vital areas of energy and food.

2. We have scattered our shots, I think, in the "make or buy" policy. We are trying to push things indiscriminately off the government lab bench into anybody's factory. Instead, I respectfully suggest that MOSST should start from Canada's strengths and needs and build on them.

"Make" research in meteorology, marine science, marine geology, wildlife, environmental protection and satellite systems; "buy" research in secondary industry, which supplies and supports our great resource industries, energy, mining, agriculture and petroleum; "buy" R&D in those industries which sell Canadian products and skills; "make or buy" depending on conditions, in border-line cases. For example, there are some forests not yet considered "economic" by industry. Make! The fishing industry cannot hope to do the massive research needed to stop the frightening slide in fish population. Make! We export raw materials such as iron ore, coal, gas, oil, uranium oxide when there must be opportunities to process them further here at home. "Make or buy", and of course a maximum possible "buy" should be included in "make".

3. We have been tinkering with the NRC—one of the world's most respected research centres. The resulting uncertainty has hampered its effectiveness.

4. We should not urge MOSST to give us numbers which statistics Canada does better and to dig deeply into budgets which the Treasury Board does better. Now they are beginning to study problems as research and development co-ordinators and advisors. Here, in my view, is an exciting prospect for the future of MOSST. They are well qualified to look at Canada's R&D with unclouded eyes.

Mr. Chairman, honourable senators, I pray that you will succeed in applying the furthest reaches of wisdom to your important deliberations. I hope that you will guide our science policy into building on our strengths and seeking new strengths either through government or through industry as deemed appropriate after thoughtful consideration.

**The Chairman:** Thank you very much, Mr. Shaw. I am sure we will get some question as a result of that statement, and I will first recognize Senator Godfrey.

**Senator Godfrey:** I think I will reserve some of my questions on your opening statement until I get to page 5 of the brief. They will fit in better there, I think.

One page 1 you make this statement:

The Engineering profession is greatly concerned, however, that it has not seen any evidence that the Senate Special Committee has acknowledged or, even more importantly, taken into positive consideration, some of the strong views put forward by the profession in its response to the recommendations of Volumes II and III of the report entitled "A Science Policy for Canada"; it is concerned that the Committee apparently intends to monitor the implementation of its original recommendations, without any attempt to incorporate modifications proposed by the engineering profession—and by other responding organizations.

I do not have a question there so much as an observation. Personally I was not a member of the original Science Policy Committee.

**The Chairman:** You are, therefore, objective.

**Senator Godfrey:** I have tried to indicate that I am trying to keep an open mind, like other people here, and I do not really think, if you look at the terms of reference of this committee, that that is their sole job. At least, I have not thought so. Some individual members, I am sure, are dedicated to the original recommendations, but, I can assure you, I am not.

**Mr. Shaw:** I can make the same disclaimer. I was not on the committee that wrote that report, either, so I will pass that buck to Mr. Moull.

**Mr. Moull:** I was on the periphery myself. I would like to ask one of the individuals who was more closely involved at that particular time if he would care to comment.

**Mr. L. M. Nadeau, General Manager Canadian Council of Professional Engineers:** Well, Mr. Chairman, this grows out of the fact that in reading the terms of reference of this newly established, or re-established, committee, it appeared to us that the committee wanted to monitor the implementation of its original recommendations. That is the way we read it, and we felt that perhaps this was not quite right. That is the reason for this remark.

**The Chairman:** I think there were two comments you made in the brief along those lines. First of all you com-

mented that in our previous reports we had not taken into consideration some of the view that you had presented to us. I feel that in this whole area of science policy we were among the first, as a group, really to attach great importance to engineering, and the contribution of engineers, not only with regard to science policy but to the innovation process, as opposed to quite a number of other reports, published either in Canada or elsewhere, in which the main concentration was really on science as opposed to engineering.

When I read your brief through I thought that it was a little bit of an unfair comment, although I do not want to exaggerate that at all. We in politics have a rather special skin, and we can take that sort of thing; but as far as the new terms of reference are concerned, I want to explain that we did not want to undertake a completely new inquiry, which would have taken, again, two, three, or five years. I think, however, that the explanations of the terms of reference make it clear that while we are especially interested in reviewing what has happened to our recommendations, we wanted to know what recommendations had been implemented, and how, and what other recommendations had not been implemented, and why. I think that makes our terms of reference fairly wide. It means also that if there are good reasons presented to us for not implementing a given recommendation, we are certainly prepared to hear them.

I think that on this note we might as well forget this part of the brief.

**Senator Godfrey:** I do not quite understand these remarks regarding the terms of reference. The terms of reference I have been operating under simply say:

The Committee, therefore, recommends that it be authorized to consider and report on Canadian government and other expenditures on scientific activities and matters related thereto;

**The Chairman:** There were explanations given in my speech when I moved that motion in the Senate, and I am sure Mr. Nadeau has read those as well.

**Senator Godfrey:** On page 2 you list certain characteristics which you say you believe future research and the development of policy options should have. I must say that when I read them I thought it was akin to the motherhood idea, and I do not see how anybody could seriously disagree with them. Consequently I have no questions on that aspect, although someone else may have.

**The Chairman:** Before we go into this, I have a preliminary question. I would like to know the relations of your two organizations with the national association of engineers, the consulting engineers. It seems to me that you have three different associations or groups catering more or less to the same people. I know part of the answer, but I would like to have that explanation on the record before we start.

**Mr. Moull:** In a sense we are a triumvirate of the Canadian Council of Professional Engineers, the Engineering Institute of Canada and the Association of Consulting Engineers of Canada. The Canadian Council of Professional Engineers, of which I am the president, represents 10 provincial associations, including the Order of the Engineers of Quebec—which is similar to an association—and the Yukon association. These provincial associations administer the provincial legislation under which engineers are regulated or licensed to practise professional



engineering. So it is this aspect of the engineering profession with which the Canadian council is most directly concerned. It has a number of other functions, as well, such as accreditation of engineering programs.

**The Chairman:** It is more or less like the Canadian Bar Association.

**Mr. Moull:** Yes, in the licensing registration side of the activity. If I may comment in very general terms the Engineering Institute of Canada is the technical arm, the learned society arm of the profession; the Association of Consulting Engineers of Canada is the business arm of the profession. We have agreements between each of us as to how we split the pie. We have overlapping areas and we have mutual agreements on how we function one with another, and we all work very cooperatively in all of these areas and recognize each other's autonomous areas, and also work closely on the overlap areas.

**Mr. Shaw:** Mr. Chairman, if I may add a little, I agree with all that has been said. There are further breakdowns arising from the explosion in technology and the complexity of today's technology, so that you will notice on the letterhead on which I wrote my opening statement that the institute itself has constituent societies in electrical engineering, geotechnical engineering, mechanical engineering and civil engineering. In addition, cross-discipline divisions in such things as management and education. I think the important point, and Mr. Moull made it, is that we never move except in consultation one with the other. Not because we are afraid of one another, but because we think it is good organization.

**Mr. Nadeau:** You mentioned other engineering organizations, and there are such other organizations. They would include the Canadian Society for Chemical Engineering and the Institute of Mining, for instance. There is a committee made up of all of these major engineering organizations called the Canadian Engineering Societies Committee which meets regularly to study problems of mutual interest, if you like. So we have this contact with all Canadian based engineering groups.

**The Chairman:** How do you relate to SCITEC?

**Mr. Nadeau:** We do not.

**The Chairman:** You are not a member of SCITEC? There is no engineering association belonging to SCITEC?

**Mr. Nadeau:** I must say there are one or two smaller organizations in the engineering field that belong to SCITEC. But, by and large, the large group, such as our own council, which includes all of the institutes of Canada, is not a member.

**The Chairman:** Why?

**Mr. Nadeau:** There is a variety of reasons. At the very beginning we tried to impress on the organizers of SCITEC that engineering should have a proportionate representation on the governing bodies of the organization, and if that organization was to speak on behalf of the scientific and engineering community—there are more engineers in Canada than all of the other scientists put together, and we were not given that privilege of having an adequate voice in the affairs of the organization. So we just decided that it was hazardous on our part to belong to an organization that could speak on our behalf without our having a proper voice in its deliberations and decision-making process. So we opted out.

**Mr. Moull:** I can perhaps amplify on that by saying in the early days we took a very keen interest in the development and growth of SCITEC, and participated in a number of their meetings, functions and conferences. But it became very evident that the turn of events that Mr. Nadeau has referred to in the engineering profession—not really being allowed to have an adequate voice in the affairs of SCITEC—that it was a futile exercise to continue with SCITEC. The support that had been evident from the outset disappeared from certainly the Canadian council and its constituent organizations in the engineering profession in Canada.

**The Chairman:** I remember well when we started the discussions about SCITEC, before it was even founded, that your predecessor, the then president of the Engineering Institute, was very active in sponsoring the first meeting which gave birth to SCITEC. I am sorry that it did not work.

**Mr. Byron T. Kerr, General Manager Engineering Institute of Canada:** If I may, senator, I think one of the basic problems with regard to the engineers in Canada in SCITEC arises from the fact that initially SCITEC was to be a forum for the exchange of views from all the sciences and the areas of technology. Despite the fact that many people seem to feel that the engineers are isolationists, that we want to go our own way, this is not in fact true.

As SCITEC developed, it drew more and more towards the function of a voice speaking for all the members of participants in SCITEC. Fundamentally this is our prime reason for withdrawing and not being involved in SCITEC today.

We have indicated to SCITEC in many meetings and discussions over the last three years that when the aims and objectives of SCITEC are changed so that it does become a true forum for the exchange of views among the total engineering and scientific communities, then we would be pleased to reconsider participation. But until that time, we are not prepared to accept any organization as the voice for engineering, as much as I dislike that term.

**The Chairman:** Mr. Shaw, you wanted to add something?

**Mr. Shaw:** Slightly further back in the discussion, I thought it might be of interest to the honourable senators to know that in those engineering disciplines which are not constituent societies of the Engineering Institute, You will find several of their members being members of the Institute's Technical Operations Board and there is a strong cooperation in cases where, for unavoidable reasons, an engineering group such as the chemical engineers does not have a constituent relationship with EIC.

**Senator Carter:** Before we leave that, may I just ask one question? Is this break-away or peeling off from SCITEC indicative of a philosophical cleavage between SCITEC and engineers? In other words, is it a lack of appreciation of the pure sciences, of the technology, and the bringing together of the pure scientists and the technologists who develop the ideas, the scientific ideas, and make them concrete?

**Mr. Shaw:** No, the engineer and the scientist tend to work very well together. In fact, if I may go back about five years, when the Department of the Environment was formed—and that department I believe hires more scien-

tists than any other organization in Canada—the minister was an engineer, as you may recall, and so was the deputy. Two out of the five assistant deputy ministers were engineers. In fact, the man responsible for fisheries as senior Deputy Minister of Fisheries and Marine Sciences is an engineer. So the working relationships, I believe, are excellent. The question of the political relationships is apparently not so smooth.

**The Chairman:** I believe some members of your delegation wish to intervene at this point.

**Mr. Nadeau:** Mr. Chairman, I just wish to re-emphasize very strongly the point made quite clearly by Mr. Shaw: It is our natural wish to talk with and interchange ideas with anyone who has relations with ourselves, which includes physical scientists and others. It was hoped, very clearly, that SCITEC, as Mr. Kerr said, was to be a forum. Instead, it seemed to us that it would be a political body, in a sense, which spoke on our behalf, and we were simply unwilling to have other people say what engineers think without engineers being allowed to participate. It is as simple as that. So, if that is the philosophy, it is only the philosophy of what SCITEC is going to do. If they are going to act as spokesmen for our community, no—if they speak for us and we are not involved. If it is to be a body of exchange of opinion, yes, we will be in it.

**Senator Carter:** But I believe the remark was made previously that there are more engineers than all the scientists put together, so you are numerically greater than all the others. What prevented you from getting a voice to which you are entitled in a general forum in an organization to represent all scientists. The point I am making is with respect to what is the nub of the problem.

**Mr. Nadeau:** It is very simple: Engineering is highly organized and very concentrated, organization-wise. So, speaking for engineers at the original meetings of SCITEC were two organizations, the Engineering Institute of Canada and the Canadian Council of Professional Engineers. The scientific community is highly disorganized and fragmented, and had dozens and dozens of different organizations, all represented; all with one voice. So when the time came for a vote on proposals we were out-voted tremendously and our proposals were just ignored.

**Senator Stanbury:** It sounds like the United Nations.

**Mr. Nadeau:** Exactly; the United Nations is a perfect analogy, but it is strictly a political situation.

**Mr. Moull:** There were organizations at that time of which many of us had never heard, and I believe there were something in the order of 125 or 150 organizations which might have been part of SCITEC. As I say, some were relatively unheard of, small organizations of a few members somewhere in the country, as compared to, for instance, the Canadian Council of Professional Engineers, which represented at that time somewhere between 65,000 and 70,000 registered professional engineers. We were a voice in the wilderness as to the manner in which the organization was growing, and it was futile.

**The Chairman:** Are you pursuing these discussions with them? It is really too bad, because I believe at the beginning, when perhaps some senators now present were not members of this committee, we more or less started the idea as a result of hearing one evening back in 1969 eight or nine different national associations with interests in research and development in health. That was the first

time they met together—the occasion of their appearance before our committee. That is how it all started.

They suggested that perhaps there was a need for a kind of umbrella national organization in which all those involved or interested in science policy would be able to meet and discuss their concerns and, perhaps, make proposals as to the major orientations which should be taken by science policy in Canada. This is how it all started, and at that time I believe it was more or less clear in all our minds, including those of the engineers, that SCITEC would in certain circumstances speak for the scientific and engineering community. Therefore, I would certainly wish that this dialogue continue so that some agreement might be reached in order that there would be more unity than disunity.

**Mr. Moull:** In answer to your question, Mr. Chairman, I would say that any activity between SCITEC and professional engineering at the time is nil and dormant.

**The Chairman:** It is too bad, because even in your brief you continually emphasize more than we have done the relationship between science and technology, and if we do not have this type of dialogue in our country when we all deplore that especially our technological effort is inadequate then, in my opinion, we are missing something.

**Senator Stanbury:** The other problem—at least it seems so to me, and I wonder if I might have a comment on it—is that in your brief you speak a great deal of the need for goals, priorities, objectives and a commonality of going forward together with priorities, and knowing where we are going. Reference is made also to industrial strategy, and so on. How do you do that if you cannot get together at the professional level to give some guidance to government?

**Mr. Shaw:** Mr. Chairman, if I may suggest it, this is the type of thing with respect to which I think MOOST would be very useful to guide and take a leadership role in, helping to create an organization which would be workable even in the private sector.

**The Chairman:** I have more confidence in the private sector and private initiative than you seem to have. It seems to me that if the scientific and engineering community cannot organize itself without government guidance and directives, we are in worse shape than you have already stated.

**Mr. Moull:** Mr. Chairman, I would like to reiterate that it was not without effort expended on the part of the engineering community to attempt to work very cooperatively with SCITEC at the outset, but for a period of what I recall to be the two or three initial years there was no response, despite our input to SCITEC. Hence, since there was a financial obligation to keep SCITEC moving, and we could see no benefit for the engineering profession to pursue this, we felt it necessary to withdraw.

**The Chairman:** I suppose we might as well conclude this discussion at this stage, because it seems to me that you are not responsible for the breakdown of relations, and we will hear representatives of SCITEC this afternoon, when we will have a few questions to ask them also.

**Senator Godfrey:** Except that we might skip to the brief of January 30, 1974, at page 6, because in my opinion that has some relevance. There you refer to the interface of science policy and representation in international rela-



tions and the fact that you do not wish the Royal Society to represent you either. I think this might be an appropriate time to make reference to this. You say that the Royal Society includes a relatively small number of prominent engineers, selected primarily on the basis of their research activities, rather on their professional practice and not acting as official representatives. I would like a little more comment on that aspect. Also, what is the percentage of engineers who are members of the Royal Society.

**Mr. Nadeau:** It is a very small percentage; there are approximately 50 engineers.

**Senator Godfrey:** Out of how many?

**Mr. Nadeau:** Out of 85,000.

**Senator Godfrey:** No; how many are in the Royal Society?

**Mr. Nadeau:** I do not know what the total membership of the Royal Society is, but there are 50 engineers—quite a small percentage.

**The Chairman:** They have established a new academy, I believe, especially for engineers in very recent years.

**Mr. Nadeau:** That is right, but there is a very small number of engineers represented there. However, our point is that it is an elitist type of organization. In other words, it is self-perpetuating; they elect their own members and the profession as such has no say in the affairs of the Royal Society. Those engineers who are members are not there as representatives of the profession; they have not been selected by the profession and have no direct contact with it, so they do not represent the engineering profession.

**Senator Hicks:** That could apply to geologists, physicists, biologists or students of history or of letters or anything else, who belong to the Royal Society. You would completely change the nature of and destroy the Royal Society if you made it that way. I do not think the engineering profession can expect to have a special lobby in the Royal Society.

**Mr. Nadeau:** All we are saying is that we do not want the Royal Society to be our international voice and spokesman. They do not represent us as a professional society.

**Senator Hicks:** By its nature, the Royal Society is not oriented towards professional people such as most of your engineers. There is no reason why engineers who are distinguished in the practice of their profession should be elected to the Royal Society. The Royal Society exists for different purposes, and it is bound to appeal only to a different type of activity which will be engaged in by a few engineers not typical of the whole profession.

**Mr. Nadeau:** That is right.

**Senator Hicks:** Any more than lawyers, because of their distinction in the practice of law, should expect to be elected to the Royal Society.

**Mr. Shaw:** Mr. Chairman, this point should well be discussed in the light of our recommendation that we should build on strength instead of trying to create some new organization to do that which is already being done rather well. In the international engineering community we have excellent relations all over the world, and again it is a combined effort between the engineering organizations. For example, the UPADI, the Pam-American Federation

of Engineering Organizations, is holding a meeting in October, and, because it coincides with the date of the annual meeting of the Engineering Institute of Canada, we have asked the Canadian Institute of Canada, we have asked the Canadian Council of Professional Engineers to represent our interests at that meeting.

Now, these relationships have developed to the point where the Engineering Institute of Canada was nominated to set up the headquarters for the World Federation of Engineering Organizations. We were beaten out by France, but I think it is interesting to note that our case was put forward at the meeting of the WFEO by Dr. Mordell of the Engineering Institute, and Mr. Nadeau of the CCPE.

So I think here is a case where, I would suggest, the committee can consider whether they should build on strength or try to create something new which they are now trying to put in an organization which is not really geared for this sort of thing.

**The Chairman:** In this area I think you should go back to what we had in mind at that time, and the problem that we are faced with as Canadians. At the moment, most of the representation abroad in the private field, at least in the scientific areas, is organized by NRC and the Canada Council which are two government institutions. I think that for a country which claims some adherence to the free market mechanism, private international relations should be organized and sponsored in some way by private Canadian organizations, not by government organizations. That was the problem which we were facing at that time, and we looked at a number of other countries, because we were not trying to set up something new, and we realized that in Great Britain, for instance, the Royal Society is used as a kind of channel. It is not used to represent different professional societies but as a kind of channel or umbrella, in close cooperation with the individual professional associations, to organize these international private relations. In France there are other organization similar to the Royal Society in Great Britain.

That is how we develop this kind of recommendation, and I do not think that if the Royal Society had been assigned these responsibilities it would have organized representations abroad in the field of engineering without consulting fully the engineering associations.

In any case, we had this idea after consulting ourselves with many people. I understand that you are strongly opposed to that and that other associations are also opposed to it as well. Probably, therefore, the net result of this will be that government organizations will continue to sponsor international relations at the private level and we will sound more or less like a country from the other side of the curtain.

**Senator Godfrey:** Mr. Nadeau, what puzzles me is that the very remarks you made as to why the Royal Society could not represent you would apply equally to the National Research Council. I just do not understand why you think the National Research Council, other than the fact that they have proved they could do it, should represent the engineering profession any more than the Royal Society should. This is what I would like you to explain.

**Mr. Nadeau:** Let us look at what is happening now within the National Research Council. It has a committee which is responsible for advising the president of NRC on these matters. That committee has tried very hard and has

succeeded to a certain extent in delegating responsibility to organize international representation to existing bodies in various specialties in Canada in both science and engineering. The engineering field have delegated all this authority to represent Canada to existing engineering bodies and primarily the Engineering Institute of Canada and the Canadian Council of Professional Engineers. In some of the scientific fields it finds it very hard to do this because of the lack of organization of the people in the particular field. So to avoid Canada's being not represented, NRC has taken the initiative, but it is trying hard to pass that back on to the individuals in the country who are members of that particular discipline, and in many instances it is succeeding in doing so.

Another point is that the cost of this international representation is very high. Many of the groups are unable to finance this so they need financial assistance. This is what NRC is providing primarily. It is providing, financial assistance so we can have adequate Canadian representation.

I believe the philosophy of NRC is that they should divest themselves of the authority and responsibility if they can find somebody to assume that responsibility in Canada. Has that cleared it up for you?

**The Chairman:** This is exactly what we had in mind. Dr. Schneider told this committee recently that they were trying to do that. But with their present divisions within the scientific and engineering community I do not know how they will succeed, because it seems to me we are in a way over organized, and yet Mr. Nadeau tells us that in certain areas we are not organized enough.

**Senator Godfrey:** It occurs to me that the Royal Society could follow exactly the same policy if it were given the responsibility, and, if the engineers were well organized, would say, "Go ahead," and would only step in where necessary. However, I think we can pass on from that.

**Senator Hicks:** If I may just make an observation, I take it no one questions the fact that, however representation may be chosen to international meetings from the Canadian science and engineering communities, government funds are properly directed towards helping the costs of that, and this is indeed a burden which the government should be willing to assume in this country as well as in any country, regardless of the political philosophy which dominates the country.

**The Chairman:** Our proposal was that there should be a transfer of funds from the public sector to the private sector.

**Senator Hicks:** Before we lead the question of SCITEC, may I ask one more question, since the SCITEC representatives will be with us this afternoon? I will ask the question by making a provocative statement and perhaps Mr. Moull and Mr. Shaw will reply.

I take it that the engineers feel that they are strong enough so that they do not need SCITEC and can see no benefit that it confers on them. Does this mean that SCITEC is a waste of effort, and so on, on the part of the other agencies which compose it as well?

**Mr. Shaw:** No, Mr. Chairman. I think we made it clear in the earlier statements this morning that if the organizational problems of SCITEC, with a hundred or more organizations on the scientific side, and two on the engineering side, could be straightened out, and if there could

be a forum in which there could be an exchange of ideas, I think, as Dr. Mordell has said, we would be delighted. That is a question of organization, and not a question of our avoiding the scientists, on whom we depend for the science which permits us to develop.

**Mr. Moull:** The trouble is that it is not the nature of the SCITEC organization so much as the direction in which it attempted to go, and I must say, personally, that in the early days I was a very strong supporter of SCITEC. In fact, I drew the Ontario Association of Professional Engineers 'nto some substantial support of SCITEC, because I had high hopes that it would succeed in being a forum for all scientific and engineering organizations. However, it surely did not turn out this way at all, and my interest waned, and I would say that the Association's interest followed.

**Senator Hicks:** I do not mean to be rude, but again, in order to get to the point before us, may I say this: Is it unfair to say that your disillusionment with SCITEC is because engineers have not had sufficient influence on SCITEC and on the development of its position and activities?

**Mr. D. L. Mordell, Immediate Past President, Engineering Institute of Canada:** I think one must concede the truth of that. We would have liked to push the policy—let me put it that way—that SCITEC would become more of a UNESCO, doing useful things, and getting people together, than a General Assembly.

**Senator Hicks:** You mean useful things like UNESCO does?

**Mr. Mordell:** Well, things like getting on with the construction side of things, and making dialogue and working together. Don't take me too literally, Henry. I mean this as distinct from making statements of position. When the General Assembly makes a resolution, the United States might feel very aggrieved at being outvoted by 99 other countries, and I think this might be our position if we saw SCITEC making statements and posturing on behalf of the community; but if we could only get together and talk we would be delighted.

**Mr. Moull:** I had a strong feeling in the last stages of our involvement with SCITEC that the engineering profession was being looked upon as a second-class citizen in this country in relation to other bodies of varying sizes and importance that were being utilized by the SCITEC organization. In fact, one of the executive members of SCITEC, at that particular time, told me, off-handedly, "You fellows are really just plumbers." That was the word he used. He said, "We want your money. We need your money. But we are going to run this show the way we want to." They look upon the engineering profession as having a fair bit of money, which they needed. This was a private conversation.

**Senator Hicks:** Do you think the attitude towards engineers and engineering institutions was different in kind from the attitude which, let us say, makes physicists feel superior to chemists, or chemists to biologists? I must not try to establish a hierarchy here. These jealousies do exist among the disciplines, of course.

**The Chairman:** Where do you put the social sciences?

**Senator Hicks:** I will stick to the hard side. But do you think the attitude towards the engineers was different



from these interdisciplinary rivalries which all of us who have any experience in academic communities are well aware of?

**Mr. Moull:** Yes.

**Mr. Kerr:** I think it is significant to note, on this one question, that at the last meeting we had with SCITEC representatives we left the door open on this.

**The Chairman:** When was that meeting?

**Mr. Kerr:** Approximately a year, or a year and a half, ago. In effect, we met to discuss ways and means of getting together. We outlined the parameters of change which we would accept, and I think those have been covered already. We have, as yet, not had any response. On the other hand, we have not taken any further initiative.

I would like to comment for a moment, also, on the Royal Society's involvement in the umbrella. In discussions with representatives of the Royal Society as recently as, let us say, a year ago, and in a discussion with Dr. Leclair, the Deputy Minister of MOSST, the Royal Society made it very clear that they recognized the strength of the organized engineering community in Canada, and at that meeting with Dr. Leclair the Royal Society indicated that they would expand their efforts towards bringing about an organization among the humanities and social sciences and into the general organization.

They also indicated that this would be a monumental job, and that they could best serve the interests concerned by doing this, thereby recognizing that additional organization in the engineering community was not really required on their part.

**The Chairman:** I must tell you, also, that the Social Research Council, which is not a professional organization, is strongly opposed also to having the Royal Society channel the representations at the private international level. So they will face a wall there too, probably, and we will again be divided.

**Mr. Shaw:** May I ask our own experts a question?

**The Chairman:** It will be a precedent.

**Mr. Shaw:** I love creating precedents, Mr. Chairman.

We have frequent contact with the engineering societies in the United Kingdom. I do not recall having any contact with the Royal Society in the United Kingdom.

**Mr. Mordell:** I would confirm that, and, Mr. Chairman, Mr. Shaw has given me the opportunity to make a comment I was going to make anyway with regard to your reference to the Royal Society of England. I am very familiar with the English pattern, because I am on the executive of the Commonwealth Engineering Council, which groups the engineering societies of all the Commonwealth countries. We meet in formal session once every two years. I am going over to London next month to have a meeting. In Britain the engineering societies operate, really, independently of the Royal Society, and the last time I had any contact with the Royal Society in any professional sort of way, as distinct from a social way, in London, at Burlington House, was nearly ten years ago.

On every visit I make to London I am in the Institution of Mechanical Engineers, or Electrical engineers or Civil engineers or the Council of Engineering Institutions,

which is really our equivalent of the TOB, although it has come by a different route.

When I travel abroad, as I do quite frequently, for international engineering meetings, it is with representatives of the engineering societies in Britain that I meet, not with delegates from the Royal Society. If I were going to ICSU meetings, perhaps there would be delegates from the Royal Society, but when it is the World Federation of Engineering organizations, the Commonwealth Engineering Council, UPADI, FEANI, which is the European one, and the Federation of Arab Engineers and the Caribbean Engineers, all of these groups are professional and technical engineering societies, and do not represent their learned Royal Society type of activity. This is world-wide.

**The Chairman:** Well, I think we have discussed this long enough.

**Senator Godfrey:** I now go over to page 3 of the original brief. Under the heading of "Objectives" you say:

Objectives—We believe that the failure of the government to maintain, let alone increase, the allocation of resources to research and development in the natural science and engineering fields in recent years and its recent decision to continue this policy during the current period of restraint are due in large measure to the absence of clear objectives.

On page 4 you state:

Goals and Priorities—We have stated our belief that the establishment of clearly identified goals and priorities is the most essential and urgent problem. Once these are defined, it will become possible and practical to determine related basic needs and to allocate appropriate resources to R&D activities.

Then you go on and list certain areas, and say:

For instance, it is our view that the following areas should be given prime consideration at this time:

I was under the illusion that these were the areas which everybody agrees should be given prime consideration. This, again, is like another motherhood statement.

Energy with the objective of achieving self-sufficiency during the foreseeable future.

I do not think anyone argues with that as an objective.

Food production with the accent on protein.

That goes back to the days of Sir John A. Macdonald and his national policy. We have been talking about that in this country for 108 years. I can say right now that as far as the government is concerned, they have amply demonstrated that. In the 1972 budget they reduced for the manufacturing industry the corporate rate of tax to 40 per cent. They gave the tax write-off. Just recently there was the 5 per cent investment tax credit.

Then we have:

Transportation and communications.

Everybody seems to agree that requires priority.

Protection of the environment.

My God, you know about that. It has held up the Mackenzie pipe line for I do not know how long.

Conservation, utilization and development of Canadian human and natural resources.

That is fine. As far as the other ones, that has been our objective for some years. I do not know if anybody dis-

putes that. You seem to think that we do not have these objectives. That is where R&D are not clearly defined.

**Mr. Shaw:** That is right. We are not doing it. That is what the whole thrust behind my opening statement is. We talk about it. But we are not doing it. I might say the statements I made were sparked by volume 2 of the report of this committee. Incidentally, you will find the figures I used in one volume, and they are not the same in another volume. But they are close enough—it does not matter which figures you use—to check my conclusion that we are not doing these things.

**Senator Godfrey:** Excuse me. You say in your brief that once these are defined, it will become possible and practicable to do it.

**Mr. Shaw:** May I come to that, senator?

**Senator Godfrey:** Yes.

**Mr. Shaw:** To check my brief that we are not giving sufficient attention to these things, I found myself at St. Andrews at an engineering meeting with Mr. Moull last week, and I took time to visit the two research institutes that I knew were there, the Huntsmen Marine Lab and the Marine Biology Station of the Department of the Environment. The state of their research is sad. Where there would be two or three men on a project, I walked into two labs where there was no one. In one case the man was away but was coming back. This was a very important research effort. In the other case, the only remaining man had grown discouraged and had gone looking for a job.

**The Chairman:** Does that mean he had no job before the lab?

**Mr. Shaw:** It meant he had no money with which to do his job, sir. Here we are talking about taking on the 200-mile limit. We are going to manage it, but at this moment we do not know how. The same applies to energy. The same applies to other protein, other fish.

The National Research Council is doing very good work, but our budget-cutting is hurting them. What we mean by these clear objectives is that the first part . . .

**Senator Godfrey:** You use the word define.

**Mr. Shaw:** Yes; to define these objectives. Our objective, as I read it, is defined that we will take industry out of government and put it in the factory. I think that is just the heading. As I said in my opening statement, it seems to me that we ought to decide in which areas we will take it out of government and put it into the factory, and in which areas we will do it by government. The whole thrust of my opening statement was in answer to your question.

**Senator Godfrey:** All I am saying is that it seems it is defined. We may not be doing the right thing. I am not arguing about that. We have surely defined our objectives, and that does not seem to be enough. I agree clearly with your statement. But clearly we have defined the objectives. At least we have done that.

**Mr. Shaw:** With respect to the honourable senators, I hope you will clearly define them as I have suggested in the last paragraph of my opening statement.

**Senator Godfrey:** I think it is defined perfectly right here. I do not think anyone will object to what you have said on page 4.

**The Chairman:** What you are saying, Senator Godfrey, is that by saying as a goal and priority we should develop the secondary industry, we do not say very much. We are all for motherhood. But that is where we should start.

**Senator Godfrey:** The problem is what should we do from then on. I think we have defined it. It is just the problem of the proper thing to do. I may be quibbling; I do not think so. I just take objection to the terminology.

**Mr. Mordell:** I would like to answer the honourable senator. I agree with him. Most of the statements (a) to (f) are motherhood statements. Let me take another motherhood statement to illustrate the difference between a motherhood statement and a definition. President Kennedy, in the late fifties or early sixties, might have said, as one of our national objectives let's put money into space research with the objective of exploring the face of the moon. This is a nice open-ended statement with no commitment. What he did say is that it shall be the national goal of the United States to have an American on the moon by 1970. I am not saying it was a good decision. My point is that he was defining a goal in engineering.

I will say, and I hope my colleagues will not disappoint me here, our first task always is to assign ourselves a very specific goal. It may be to build a bridge, a factory, an airplane, but a goal that can be identified. Then we can plan how we are going to do it in the best method. What our two presidents are saying is that so far we all say we need these things, but no one has tried to identify specific amounts in specific times.

**Senator Godfrey:** You have just made my point.

**The Chairman:** It might be useful if you tried to give a more specific target in your brief.

**Senator Godfrey:** I think we all know what we need. How to do it is the problem.

**Senator Carter:** I wonder if Mr. Mordell would carry on and give us what he thinks the priority should be. What goal should we aim at in, say, energy at the present time that is the equivalent of putting a man on the moon? What would be the equivalent in respect of energy?

**Mr. Mordell:** I obviously cannot answer that question at the moment. What it should be is that by 1985, say, we will be self-sufficient in energy. This is our first target. There are many ways of changing it. But to set a date, I am not confident it should be 1980 or 1985 or 1990. But I suggest we should set a definite target, and then plan to achieve it.

**Senator Carter:** Are you saying that the government should say this, the engineers, or all of the scientific community?

**Mr. Mordell:** Fundamentally I say government—the people. We need input from engineers. One way of achieving it would be to go back living in wigwams, in principle. There are those who say abandon the motor car, and a lot of things like that. I see there is a function of government with advice to more people. Government has to make its decision when it has heard the different views. We see Hydro Quebec telling the Government of Quebec that they want to expand power in Quebec by 7 or 8 per cent a year for the next 10 years. Government in Quebec is apparently beginning to quibble a bit, and say whoa; it is government responsibility.



**Senator Carter:** I agree that it is government's responsibility. But as Mr. Shaw pointed out, this committee is at the heart of the government efforts; and the government seems to be suffering heart failure. The government is not going to act unless public opinion forces it to act. Government responds to public opinion. The energy institute has a responsibility to put pressure on the government. That is why I am concerned about this division with SCITEC. It seems to me there is a fear that between your two bodies you have different common goals. There are some goals you do not have in common. Certainly the whole scientific community should be speaking with one voice in these matters. Otherwise government will never move.

**The Chairman:** We have seen the American government choosing the target of 1980 for self-sufficiency, and I understand the scientific community does not agree with this, or says that it is completely impossible.

**Mr. Shaw:** Mr. Chairman, Mr. Mordell is a teacher and researcher in engineering. Therefore, he would not answer your question as to what we should do in energy. I have no such inhibitions. I believe that the government in this case should be driving ahead on research on the thorium cycle of the CANDU system of nuclear energy in order to control our supplies of uranium.

**The Chairman:** We have been told by AECL that it would take 20 or 25 years before this would become practical.

**Mr. Shaw:** I believe they were referring to thermo, and that is fusion.

**The Chairman:** No, I believe it was thorium.

**Senator Godfrey:** They were speaking of thorium.

**Mr. Shaw:** It took 30 years to do the present CANDU, and I think we should get on with it because we will run out of uranium sooner or later, and it gives, I understand, a type of fast breeding.

Now, if I may go further, it was because of reading your evidence and this statement to which you refer that I went further in my opening statement and said that we should concentrate on R&D in those areas which are of peculiar benefit to Canada. We had a long discussion on wind power, for example, which is in my opinion a most useful aspect in this area, and solar energy, which to some degree will help us to conserve other sources of energy. However, the important point is that we seem to work on the development of any part of secondary industry, and I believe that is a refinement of the objective. We should consider those secondary industries which support our primary industries in which we have such a great strength, and those secondary industries would receive and process the output of those primary industries. We should not scatter our shots too much, but actually select areas in which these things should be done. As a matter of fact, in my opinion NRC does a reasonably good job of this. However, if we come up with something which cannot be marketed, that is research, but I believe in their selection of those things that they are trying to promote they tend to fall into those areas which are most useful although occasionally they get enthusiastic about some certain little area.

**Senator Godfrey:** Of course, we heard from the Canadian Chamber of Commerce and the Canadian Manufacturers' Association. Did you read their evidence?

**Mr. Shaw:** No, I stalled at number 15.

**Senator Godfrey:** I agree with you, but they would not. They just wanted the government to give tax credits on all research and development, without any orientation whatsoever and "keep your fingers out of this", and so on.

**Mr. Shaw:** So they would be able to make a better transistor radio but never be able to market it against the Japanese.

**Senator Godfrey:** As they said, they are profit-oriented and in spite of the fact that it is the thing they should be doing they want the government to give tax credits and not be selective in any way, which is exactly the opposite of your views. So I am very interested in your comment.

**Senator Stanbury:** Mr. Chairman, first I wish to say that I think Mr. Shaw has done us a great service by making that effort to define more clearly what these objectives might be. My concern really, using the same example as that of Senator Godfrey, is the difficulty of arriving at any agreement. Again, we can get agreement on the motherhood statements with no problem at all, but as soon as we move into the thorium process we are immediately up against all kinds of opposition and people who would not agree with it at all. As soon as we say we must define these objectives and say exactly what we are going to do, we are up against the CMA, the Canadian Chamber of Commerce and so on, who will not agree with it at all. We were saying a few moments ago that it would be helpful if the engineers, SCITEC and various other elements could get together with, perhaps, CMA, the Canadian Chamber of Commerce and so on. If we could find some method of getting them together we might arrive at some consensus.

It seems to me, though, that the problem in Canada, as much as anything else, is one of maturity. In other words, many of those organizations, particularly SCITEC, are relatively immature. There has not been sufficient time to develop them in order to make them more mature and many of our professional organizations seem to have problems of a certain chauvinism because of immaturity. All these jealousies exist in other countries, yet they manage to get together. So we are no different from anyone else, except that we have not worked at it for quite so long.

You suggested that MOSST could maybe do this job, but government has had much experience in stating objectives with which everyone immediately disagrees. That will not get us anywhere. Have you any suggestions as to how we move to a point at which we get at least a reasonable consensus at the level to which you referred, at the point at which you begin to say yes, we are in favour of being self-sufficient in energy and when, by what means and exactly who is going to do it?

**Senator Hicks:** May I just add to Senator Stanbury's remarks. With reference to your statement that government seems to be awfully good at stating objectives with which everyone disagrees and that gets nowhere it is even more appalling that on page 4 of this brief certain objectives have been suggested, and we have said everyone agrees with them and nothing gets done. That is the frightening part of it.

**Senator Stanbury:** It is the details on which agreement cannot be reached.

**Mr. Shaw:** Of course, I agree that these objectives have not expanded. I have attempted to break them down in my opening statement, which was sparked by the evidence

before this committee. However, I obtained much of my information from an excellent meeting of the Ontario Engineering Advisory Council, which brought together a group of the type of people to which Senator Stanbury referred to discuss productivity. I would say that the application of these figures to the record of that meeting is what you have heard in my opening statement. Now, the quiet and very effective gentleman who wrote those minutes is Mr. Sentance, and it is time we heard from him in answer to that question.

**Mr. L. C. Sentance, Acting Executive Director, Association of Professional Engineers of Ontario:** You really give me an almost impossible task. Obviously, with all that has gone into this over so many years with no solutions, I am not going to offer one today. However, I think the comments on productivity referred to by Mr. Shaw did help to put forward a few thoughts and I am sure, if you gentlemen have any interest in this, copies of the proceedings can be forwarded to you.

However, the conference really concluded that productivity, of course, is a mixture of many, many things. It must be contributed to in political, technological and social ways and all the corresponding effects must be apparent somewhere along the line. There was a great deal of interest, of course, in the contribution that technology could make to improved productivity. However, it was perhaps even more interested in the encouragement that the government could give because of its unique position. It does seem to the people who attended that government, labour, industry and technology, business, if you like, and technology can contribute if they can somehow be brought together. I believe the conclusion was that the only party of those who had the potential for bringing these groups together was the government and the sort of basic suggestion was that government might, as Mr. Moull indicated to you this morning, take the lead in encouraging representatives of industry, technology and labour to sit down and begin co-operative discussion in some kind of an independent and central house of productivity, or institute of productivity.

We could begin a cooperative discussion in some kind of independent and central house of productivity if you want, or institute of productivity. There is some parallel, of course, in this to what has recently occurred in the United States in the establishment of a productivity organization. So that really was the essence of it. The government could probably do more in this situation than anybody else by encouraging these groups to come together. Once together, I think there are some possibilities that they could make headway, but it is a long road upwards, obviously.

**Mr. Moull:** Mr. Chairman, if you would agree, I should like to provide a copy of the recommendations and the proceedings from that OECD conference as an appendix to the proceedings today.

**The Chairman:** I think we should have the recommendations printed as an appendix to today's proceeding.

**Senator Yuzyk:** I so move.

**Hon. Senators:** Agreed.

(For text of Appendix see page 29)

**The Chairman:** The other document, being rather longer, we will simply circulate among the members of the committee.

**Mr. Moull:** Both documents were the basis of some of the comments Mr. Shaw and I made.

**Senator Stanbury:** Mr. Chairman, the benefit of that, to my mind, is not only the results of the discussion but the method of organization of the seminar, or whatever it was, and who took the responsibility for it and so on. Is there some indication of that in the summary?

**Mr. Moull:** Yes, very much so. More so in the proceedings than in the summary, however.

**Senator Yuzyk:** By "governments" you really mean MOSST, and that MOSST should play this role of encouraging the cooperation of the various groups in this country—not only encouraging, but really initiating.

**Mr. Sentance:** The seminar itself did not identify MOSST, but I think from the discussion this morning it has been suggested on two or three occasions as certainly the possible source of this kind of encouragement.

**Mr. Shaw:** May I suggest also, Mr. Chairman, that the NRC is a very valuable organization.

**Senator Godfrey:** Mr. Shaw, in your opening statement you said that "Canadian productivity, by reason of scale and other factors, continues to lag that of the U.S.A. by some 20 per cent." I should like more detail on that 20 per cent, because we have had evidence that the steel industry is just as productive and economical as that in the United States, as are our motor car industry, with the auto pact, and our forest industry. What is this 20 per cent? Is that certain types or an overall average, and how did you arrive at that? It quite astounded me. I am well aware of the arguments for the economies of scale. According to evidence we have had before the Immigration Committee, it would be necessary for us to have a population of 100 million people before we could begin to be big enough to have the kind of economies of scale they have in the United States. However, we could achieve the same kinds of economies of scale by concentrating on exports, so what is that 20 per cent? I would like more detail on that.

**Mr. Shaw:** Mr. Chairman, two years ago I lost my research staff. However, I can identify where this information came from. That statement comes from the seminar of the Ontario Engineers' Advisory Council on Productivity. I believe the statement was made by General Electric, but I am not positive.

**Senator Godfrey:** I would not want that statement on our record without a little more detail, which you obviously cannot give us today.

**Mr. Sentance:** The 20 per cent figure was put forward by a representative of General Electric, as Mr. Shaw has indicated. It was a general statement based on his personal knowledge and experience of secondary industry. He spoke from the standpoint of secondary industry, and that percentage is an assessment of the secondary industry situation. It is not, as you properly pointed out, the same in primary industry. But if you will just look at secondary industry, you will see that he generalized on this kind of relationship, but he was able to give quite specific comparisons from his own organization which operated identical plants on both sides of the border. It happened that within very few percentage points the general and the specific were close together.

**Senator Godfrey:** I can quite imagine that that would apply to General Electric and certain other industries, but



the impression given is that this is an average, and I want that clarified.

**Mr. Sentence:** It is the average for the secondary industries.

**Senator Carter:** May I add a word on this, Mr. Chairman? The president of General Electric and the president of the Aluminium Company of Canada appeared before our Foreign Affairs Committee before the adjournment. They gave comparisons of their Canadian companies' outputs and their American companies' outputs. I think it ranged from 18 per cent to 20 per cent of their plants in Canada as compared with their parent company plants in United States. They made it clear that in the steel industry we are on a par with United States and in the forest industry we are on a par, and perhaps even a little better, and that in several other industries we are on a par; but it is mainly in the manufacturing industries that this 18 to 20 per cent applies.

**Senator Godfrey:** That clears it up, I think. On page 5 of the brief it says that much more effort is required to bring Canada in line with other industrial nations in the proportion of government R & D expenditures allocated to industry and to redress the imbalance which continues to exist in this country and which favours so highly in-house R & D.

In your opening statement, Mr. Shaw, you talked about comparing one apple and nine oranges. My impression was that you did not quite agree with that statement in the brief in your opening remarks, or, to put it this way, I would like your comment on how you reconcile the two statements. Incidentally, the brief is a joint brief, is it not?

**Mr. Shaw:** There is no disagreement between the two statements. I would pray that this committee would tear up the OECD table and then accept the words in that brief which say that we should improve the amount of R & D in industry. But we should not, in my view, attempt to make them match with the Netherlands.

**The Chairman:** You quarrel with the figures but you come to the same conclusion.

**Mr. Shaw:** I believe there is work to be done, but it should not be based on the OECD tables. Canada is one of a kind in that list of ten nations.

**The Chairman:** I would question that. If you look at one of the tables we produced in volume 2, and consider the distribution of employment by major sectors of industry, you will find that we are very much like the United States.

**Mr. Shaw:** Yes sir, except for the economies of scale that we were talking about before.

**The Chairman:** We are not talking now about the distribution of employment, which reflects, I think, the structure of the two economies in terms of productivity and so on, but the structure of the economy.

**Mr. Shaw:** The point I was attempting to make was that we should thoughtfully consider our own strengths and build on them, and be very cautious about trying to build on great weaknesses. We should not do so on the basis of that table, because we will never make it. We will always be down at the bottom of that table as long as we are a resource-based economy, in a country 3,000 miles wide, with a huge Arctic which is a thousand or two thousand miles high.

**The Chairman:** Let us not bother with comparisons. We agree with the conclusions.

**Senator Godfrey:** Yes. I think the Canadian Chamber of Commerce made the same point, that it is not exactly comparable, for instance, because we have available a lot of research from the United States that does not apply, necessarily, to some European countries.

**The Chairman:** And which always comes too late for us to be able to export.

**Senator Godfrey:** The chairman discloses a slight bias there.

You also make a statement to the effect that the relationship between government and industry could be greatly improved. We hear that a great deal. I address this to Mr. Shaw because he has been on both sides of the fence. Who do you think is mainly to blame—or is it 50-50? What would your assessment be?

**Mr. Shaw:** I think relations between government and industry are not bad at the working level. I think that both government and industry have something they would like to sell to the public, and that the statements outside the meeting room are sometimes stronger than they are inside the meeting room. I believe the mistrust on the part of industry is based on the myths about government and the civil service that we all know about; but also on their restlessness with regard to controls, which may be necessary, but which, at this moment in history, are damaging to industry's profit picture.

When I say, for example, that we are not spending nearly enough money on important research, in which we are drastically losing ground every day we are not doing it—for example, in the fisheries field, and there are many others—I recognize that the reason for it is the anti-inflation program, but this creates restlessness. The exploration for resources, particularly in petroleum, has been suffering from problems arising from taxes and royalties, and other escalations. Somebody mentioned environmental meetings. They take time, but it is a known amount of time, and will become rather more regular, if I may switch to the specific for a moment. This adds to the planning period, but it is a known amount of time.

I think these sorts of things create a restlessness, but when you sit down and work together on a project, as the government did with industry in the Beaufort Sea, the relationship is usually quite good. I am almost tempted to say, Senator Godfrey, that you could answer the question you asked me better than I can.

**Senator Godfrey:** At the bottom of page 5, you say:

We also feel that the Special Committee should, in its review, be less concerned with mechanisms and concentrate its efforts on short-term objectives.

I really find that difficult to understand. As I pointed out, we all know what the objectives are. To me it is the mechanisms, the method of going about things, that are causing difficulties. Have I not understood correctly?

**Mr. Moull:** What we are really trying to say there is that the long-term objectives of the committee are evident, but the short-term objectives are not quite so evident. Possibly Mr. Nadeau could expand on what our concern was there, and what we are talking about.

**Mr. Nadeau:** I think it was probably explained by Mr. Shaw previously. Apart from motherhood statements, we do not have clear-cut immediate short-term objectives.

**Senator Godfrey:** Do we have clear-cut short-term mechanisms to achieve the objectives?

**Mr. Nadeau:** We want the objectives first, and then we can develop the mechanisms. But where are the objectives clearly stated?

**The Chairman:** Well, we have some objectives in relation to "make or buy", and they have not been attained, as you say in your brief, and it seems to me that the reason why we did not attain them was largely because we did not have the proper mechanisms to make the policy work.

**Mr. Shaw:** Mr. Chairman, if I may suggest this, it would be helpful if the objectives had not been so general, and if we had thoughtfully considered those areas in which there is apparently a more useful direction than in others, for instance in secondary industries, to come back to the example that was used before, or those secondary industries which feed our primary industries, our strengths, and those secondary industries that are fed by our primary industries, rather than being too excited because we have discovered a new laser that will help thermonuclear energy. I think this is wonderful, but I do not think we should spend our lives trying to sell it all over the world. There will not be that many of them made in the foreseeable future. I am quoting now from the minutes. To me, there is the lack of refinement of objectives.

With regard to mechanisms, the engineers had the feeling that this committee was recommending new mechanisms without attempting to strengthen the existing very fine ones. I even went so far, although I hesitated a little, as to say that we seemed to be tinkering with the NRC, with its library, its information system, its organization, and its granting system. I personally would have preferred it if we had been strengthening the NRC rather than changing it.

**Senator Lang:** Who is "we"?

**Mr. Shaw:** Canada. I included myself and everybody else who has appeared before you.

**Senator Hicks:** And the preliminary report of this committee, with which I was careful to disassociate myself the first time I commented upon it in the Senate.

**The Chairman:** We could have a long discussion on that, of course.

**Mr. Shaw:** That has become a political discussion, so I must quickly withdraw; but I would suggest that the ideas you expressed were probably received from some of your witnesses. So I have made that "we" very deliberately the Canadian "we" and not some particular group of Canadians within it.

**Senator Bell:** Mr. Chairman, could I follow that up with a question with respect to page 5? I am not very clear about the capability or the resources of the engineering consultants in Canada to undertake more work outside. You say the in-house proportion greatly outweighs the industry, and so on. With the difficulty we are having with universities increasing their capacities and their staffs, have we got this reserve of engineering capability within the country to undertake what you are suggesting?

**Mr. Shaw:** Yes.

**Mr. Moull:** I would say emphatically yes.

**Mr. Shaw:** Each of Canada's five biggest consulting engineering firms, for example, work in 30 to 40 countries right now. Our universities give me a feeling of great strength in the engineering communities. I would hope that Dr. Mordell would make a comment. He has been the Dean of Engineering at McGill and the President of Ryerson and is a researcher, himself. Engineerins are more frequently developers, as for example the consulting engineers, but they do a lot of research. But I would hope that Dr. Mordell would comment on that.

**Mr. Mordell:** Mr. Chairman, Mr. Shaw has given me a rather open-ended entry to a debate. I would subscribe to the view that Canada is relatively well prepared to handle a great deal more engineering work than it is now doing. I say "relatively well" because I think there is, as always, room for improvement. It is a question to what extent we are talking about. I have seen over the past decade, or decade and a half, in most engineering universities a very great change. I might illustrate this very simply by saying when I first joined the staff of McGill in 1947, the head of the Civil Engineering Department had designed every bridge built by the Province of New Brunswick for the last 20 years. The head of the electrical department designed every transformer used by the Shawinigan Water and Power Company. Another civil engineer had designed the dams on the St. Maurice Valley. So they brought to the students a very real appreciation of what I have called down-to-earth, practical engineering problems.

Today, perhaps you find more commonly staff at these universities who are far more distinguished by research. I would emphasize that research encompasses many roles. A role inhabited by many engineering professors today is hardly distinguishable from that of many scientists. In other words, they are not concerned with the building of bridges or dams. This is a weakness.

You were asking earlier about the feelings of scientists and the engineers. Let us look at the doctors for a moment. It is, of course, very clearly recognized that it is quite proper for a doctor to have blood on his hands. Indeed, if the doctor has not got blood on his hands from time to time, you would be loath to let yourself be treated by him. You would think he was too theoretical and did not know enough about the practical things; he did not have a good enough internship. Over the past few years perhaps there has been a weakness in engineering education. They are not getting their hands dirty. By reference to some of the scientists, I think my friend Bob Shaw said that we were just plumbers and get dirty hands. As I say, it is quite proper in the university for the medical doctor to be seen in a white coat with blood on his hands. But it is regarded as *infra dig* if you see an engineer in a boiler suit with grease on his hands.

I think that there is more need for development. But I think we are very well geared. Most of the companies, indeed, are well aware of the need to develop more human resources and are taking steps to do this. I am completely confident that not only can we provide for the expansion of the Canadian effort, but I am also personally convinced, for reasons I will not take up your time by mentioning now, that in achieving this self-sufficiency in engineering we may be able to help many third world countries to achieve their self-sufficiency in engineering.



**Senator Bell:** If I may enlarge a little bit on this, I would say that I am most relieved to hear this . . .

**The Chairman:** Senator, while I am sure that it would be a very interesting discussion, we will have the consulting engineers with us this afternoon. I think it would be preferable if we left this until this afternoon because we have only one hour left. I think Mr. Shaw will have to leave right at that time because of a previous appointment. If you would reserve these questions for this afternoon, it might be a better time.

**Mr. Moull:** I would like to add one comment here, that what the honourable senator is asking relates more than to the consulting engineering part of our profession in that we have some 85,000 registered professional engineers in Canada. Approximately 10 per cent of these people are in the consulting engineering area, and have proven their excellence on projects not only in Canada but offshore as well. We must not ignore the other 90 per cent of these registered professional engineers who are doing a variety of things throughout our whole economy, and largely in the manufacturing area, from which a great deal of design that results in things in Canada and elsewhere emerges. I will use the CANDU reactor as an example which has been done largely by engineers in industry and AECL, and so on.

The final point I want to make is that numerically there is one registered engineer in Canada for every 275 men, women and children in this country, which is a pretty high density of professional people. It is not only the ability these people have, but their responsibility and accountability, that to me is evidence that suggests there are very few, if any, projects which cannot be taken on and handled fully by the Canadian engineering profession.

**Senator Bell:** Thank you.

**Mr. Shaw:** Mr. Chairman, may I point out that Mr. Schneider's evidence in reply to your questions about the development of specific projects would confirm that statement. When they see a possibility they move quite well through the system of the NRC.

**Senator Godfrey:** I am finished.

**The Chairman:** On page 5 you refer to the "make or buy" policy, and you say this policy is being reviewed and the possibility of extending its application is being examined. Mr. Shaw has more than expanded on this in his opening statement. Do you think the "buy" policy should be extended at the moment?

**Mr. Shaw:** I do, Mr. Chairman.

**The Chairman:** You mentioned in your statement, Mr. Shaw, in paragraph 2:

"Buy" research in the secondary industry which supplies and supports our great resource industries, energy, mining, agriculture and petroleum.

You do not mean the Department of the Environment?

**Mr. Shaw:** Yes; I do.

**The Chairman:** You mention "make". I was wondering if, in your position as a former deputy minister of that department, you could tell us something about the application of that policy in that department because, as you know, it has a very large R & D budget, not only in the field of environmental protection but also in the field of

fisheries research and forest products, and all kinds of other things.

**Mr. Shaw:** I hope I will be forgiven by my successors, Mr. Chairman. The Department of the Environment showed up in the early days of "make or buy" as the white-haired boy who was doing all of the buying. I did not think we were entitled to that credit because at the same time came these huge projects which I am sure at least equalled the increase in the government's total science budget.

Of course, it is very easy to buy a ship, an airplane, a survey and make a great dent in the "make" in figure, and a bump in the "buy" figure. I do not believe that that was the object of the game, and I said that, in effect, in my opening statement. I believe that we should, indeed, buy whatever we can. However, for example, in the atmospheric environment to which I saw reference, of course, we can buy the gauges by which, the weather station takes the data, but we cannot buy that huge research program in the middle of the Atlantic ocean, where the Canadian ship *Quadra* was the flagship of a fleet of some 17 nations and many aircraft in an attempt to forecast as accurately for two weeks as we now can for two days. That we must make. However, in the process we might buy some of the scientists. I can never understand why the universities were not included in buying, incidentally, because normally when a meteorological ship goes out the people who are paid are from the universities, rather than industry, which is not in the meteorological business expect in the sense that it uses the information obtained from government meteorologists.

**The Chairman:** But in the field of fisheries research, and forestry and forest products research, how much did you buy?

**Mr. Shaw:** In forestry?

**The Chairman:** Yes, or forest products, because it is closely linked to secondary industry.

**Mr. Shaw:** Yes, in forest products there is a good deal of buying, and there is a great deal of combined action. In fisheries the buying is usually the platform, or some engineering or gear. The mid-water trawl is a Canadian development which I personally regret a little, but it has improved the efficiency of our fishing, and we have not yet found out how much fishing we should do. The fishing industry does not have money to buy research. It is, therefore, except for the platform if you wish and some of the gear, all "make" and I suspect that this must continue because it is very important to the protein supply of the world.

In scientific forestry the industry does most of it, I would say, but government does transboundary and across-the-country types of things—all the work with wild plants, which is part of forestry, and all the work in the so-called unproductive forests. When it comes right down to the forest products labs you will find the weight is there in industry, but again there are forest product labs in government and the Advisory Committee on Forestry in my day was asked to look at this to determine whether we could close them. This was under the chairmanship of Mr. Beaupré of Domtar, and they came in enthusiastically to work at closing them up and putting it all in industry, but they finished up suggesting that we should not be too hasty with it. In other words, the work they do runs across disciplines and is, therefore, quite useful to forestry. As an

example, they not only select the wood to make laminated beams, but also the glue. It is that type of research in which they are most useful, and run into other industry.

**The Chairman:** In my days they were also attempting to produce an artificial cow to produce artificial milk. However, when you were deputy minister did you not feel that in applying the "make or buy" policy you were in a conflict of interest between "make" and "buy"?

**Mr. Shaw:** Yes, I thought then as I feel now, that the "make or buy" policy was being applied rather indiscriminately without that assessment of where we need it and where we do not need it, where we should have it and where we should not have it. I got that load off my chest earlier this morning.

**The Chairman:** But the pressure from your own people in your former department has been to make, rather than buy.

**Mr. Shaw:** No, I do not think so. If we come right down to the internal office politics, if you can buy you will get it through Treasury Board and get the job done. If you try to make it, it is much tougher. So I did not feel there was that response. The response was, "Who in the world are we going to buy from?" When we were talking about meteorology at 50,000 feet, or fisheries, or forestry at the tree line in the Arctic.

**The Chairman:** So you felt that you applied the policy up to its potential, and there was as much "buy" as was desirable at that time?

**Mr. Shaw:** Not only that, but I personally believed in it, so I pushed to "buy" policy, and I found my results were mostly in the area I mentioned, in which we were not really breaking new ground. It was easy to do it on the Mackenzie Valley.

**Senator Stanbury:** I do not wish to anticipate the evidence of other witnesses, but we will be hearing the biologists tomorrow and this relates very much to what you have just said. In their brief they complain rather bitterly that there are so many things that should be done, and are, in fact, being done in Canada, in the environmental field which involve biologists and biological problems and that they are not being done sufficiently through what I suppose we call the "buy" side of the policy. In other words, we are not using the university biologists, and I think they are principally concerned about university biologists, because again I suppose there is not very much of an industrial side of that particular profession.

Have you any guidance for us in the respect? Are there areas in these huge projects in which we are not using biologists and related disciplines simply because of this problem of organizing them? In other words, the people in the Department were asking, "Who in the world can we get, or how can we organize these people so that this major project can be carried out by someone outside government? It is easier to pull it into government and do it ourselves."

**Mr. Shaw:** I think that is quite right. If you consider the university biologists you will find that there are very few biological projects. You will not find the university community participating in the "buy" situation. Where we are in danger of missing is with our anti-inflationary program. I am two years out of date, but I did spend some of this last week-end walking around to biology labs, because

they were the only kind of government labs that were around and I have never lost my total fascination with the Department of the Environment. I found that the Huntsmen Marine Lab, which is supported by 10, 12 or more universities . . .

**Senator Hicks:** Not very significantly, however.

**Mr. Shaw:** Not very significantly. They are also supported by at least one provincial government, I believe, and by the federal government which is sticking strictly to a schedule of financial grants which was established five or six years ago. The Huntsmen Marine Lab said, "Please, we cannot live with that; times have changed", and the government came right through with the agreement on the figures settled five or six years ago and the lab was suffering.

**Senator Stanbury:** But that is not being supplemented by buy programs.

**Mr. Shaw:** Yes, it is, to the extent that there is much hardware, but it is also a big buy for the government in its research program, because their effort is to cross-breed salmon and trout among others. However, the big thing is to get a particularly strong breed of salmon and to train it not to go to Greenland. There are salmon species that do not. So their intention is to increase its rate of growth by cross-breeding and to train it to come back to rivers which have lost their salmon because of pollution and other causes, but which are now being cleaned up, and the effort in the produce salmon which will go back to one of those rivers where the salmon used to go. That will be tremendously valuable to the fishing industry. I think that is good both researchwise and industrywise, and all they need is a few dollars.

**The Chairman:** How is it that the biologists in universities are complaining bitterly that there is so much in-house research in their field, especially in your former department? Probably they are wrong.

**Mr. Shaw:** Yes, I think I could say that I would not necessarily agree with them. I hate to answer that two years out of date, but I would suggest that there is at least some normal human nature in that complaint, and that you should examine it case by case.

**The Chairman:** Again on page 5 you state that in your opinion government procurement in R & D expenditures should be made substantially more consistent. What do you mean by this?

**Mr. Shaw:** Well, the inconsistency is pretty easy, because the ups and downs that you show in the charts at the end of Volume 2 of your report indicate a lack of consistency in the amount of support which the government puts into its science budget generally.

**The Chairman:** Would that mean that they should perhaps try to look more at the medium term and organize a so-called science budget over a period of more than one year, looking forward to the next three or five years?

**Mr. Shaw:** The department, when I was there, produced ten-year plans. I ran into a little resistance when I suggested it, because, as one of the dear old assistant deputy ministers now retired said to me, "When you work for the government you have the privilege of change," and my answer to that was, "You should make a ten-year plan; you should lop off a year every year and add a year so that you keep it current, and then you can try to direct your



policy, based on the political considerations, as nearly along the plan which is related only to the mechanical endeavour or technological endeavour of the work." So I would say that the ten-year plan is my preference, knowing that in ten years it will not look like a ten-year plan, but knowing that at least it gives some direction to your thinking.

I hope I have answered your question, Mr. Chairman.

**The Chairman:** You seem to indicate that there is forward planning in this area, which is rather incompatible with the statement in the brief.

**Mr. Nadeau:** Perhaps I can clarify that for you, Mr. Chairman. The idea here was that we felt that government procurement is a big thing. The government is the largest purchaser of goods and services in the country by far, and it was our feeling that reasearch and development expenditures should be more consistent and tied in closely to this government procurement. The government knows that it is going to need so many things.

**The Chairman:** You mean consistent between the two, between procurement and research and development.

**Mr. Nadeau:** Yes, between procurement and research and development. That was the meaning of that particular paragraph.

**Mr. Shaw:** Obviously, I did not answer your question, Mr. Chairman. I am sorry.

**Senator Godfrey:** You have some kind things to say about the National Research Council on page 6. In view of the previous discussion, is the engineering profession adequately represented on the National Research Council itself, in your opinion.

**Mr. Mordell:** In terms of numbers, I would guess that it is perhaps 25 per cent or so. It would be somewhere between 25 and 30 per cent.

**The Chairman:** You mean on the staff or the board?

**Mr. Mordell:** On the Council. I think the engineers feel that there are good engineers on that board; they have been by no means predominant but their voices are heard, and I would emphasize very strongly this current movement. We have watched with very great interest over the last several years what I would regard as a very good evolution in the NRC, looked at purely from the engineering point of view, of course, in terms of their policy. We have been brought in more and more and asked to contribute ever more. So what we are saying is, "Here is an operation which is moving well. It should continue."

**Mr. Moull:** I guess the answer to your question, Senator Godfrey, is yes.

**Senator Godfrey:** Even though you are not in the majority, there are enough of you.

**Mr. Moull:** There is enough confidence on our part that the job is being done adequately.

**Senator Lang:** What is creating the uncertainty contained in Mr. Shaw's brief?

**Mr. Shaw:** I think the action taken by the government, possibly as a result of the recommendations of this committee on granting policy, which I think is still not settled, and other things such as the library policy. These have

slowed down the thrust of the National Research Council particularly in the grants area, and in that respect I believe that the biologists have some claim for an improvement, as do the other sciences.

**The Chairman:** I can understand the complaint of biologists, because they say that the granting system as managed by NRC at the moment discriminates against biology. That is what they claim. But I do not see what that claim has to do with the division of function, which was reached not only by us but by all kinds of other organizations. They do not have enough money. That is the problem. It has nothing to do with the division.

**Mr. Shaw:** Personally, I mistrust the division of function. It seems to me that when the NRC is on to something it should have all the resources at its power to carry that through, and that their granting system should reinforce their strength.

**The Chairman:** Do you know how much time the present board of the Council, according to the President of the Council, devotes to the granting function, and to the labs?

**Mr. Shaw:** No, I do not.

**The Chairman:** We were told that the board of the Council was devoting most of its time to the granting function, so if this is true—and it is not our claim—do you think it is normal to have a board which pays very little attention to the operation of the labs?

**Mr. Shaw:** No, I do not; but I would suggest that it would not be very difficult to make a small adjustment in the organization of the NRC which would enable them to do both.

**Senator Godfrey:** When I was a member of the Canada Council I had a very strong suspicion that the staff kept us so busy on the granting side that we had no time to spend on the broad policy side, which they settled.

**The Chairman:** And you had no labs?

**Senator Godfrey:** Right.

**Senator Hicks:** I dissociate myself from that, and can only conclude that after I left the Council it deteriorated.

**The Chairman:** I must declare my interest here. I appointed Senator Hicks to the Council.

**Senator Hicks:** Ah, yes. There were some very good appointments in those days, Mr. Chairman.

**Mr. Mordell:** Could I comment, please, on the NRC granting function? I was involved in that process for many years in one sub-area, and I would pass no judgment as to how much time the Council spends on granting; but from where I sat I would have thought it probably was a rather small proportion because there was a whole structure of committees in every area, of one of which I was a member, which went through all the minutiae in appraising these, and it was always my understanding—and I emphasize that it is my understanding only—that the Council's main function was to cut up the cake into three or four big pieces and then delegate the authority for the sub-division of these segments of the cake to the various granting committees.

**The Chairman:** Well, according to the information we have—and we got it from various sources, including Mr.

Schneider and from a letter which I remember receiving at that time from Mr. Bonneau, who was then on the board—you are wrong. It may have changed since, but I think Mr. Bonneau mentioned in a letter that he sent me several years ago that the board of the Council was devoting 90 per cent of its time to the granting function.

**Mr. Shaw:** It seems to me that the over-riding consideration should be the support which the grants give to the programs of the National Research Council and the government at large, and they should adjust their organization so as to take care of any wheel-spinning.

**The Chairman:** Well, I suppose that is because most of these are outside people. They cannot meet as often as would be necessary to meet all your requirements. This is another difficulty. That is why, perhaps, we decided to make, and the government decided to accept, the recommendation that there should be two different bodies. In any case, as far as I am concerned, at least, it is not my intention to recommend to my colleagues on the committee that they go back to this area in our next report.

**Senator Godfrey:** I have no more questions on the brief, but I would like to ask one or two questions on the previous brief of May 19, 1972.

**Senator Lang:** I have a question on a comment in the brief with regard to the function of MOSST. In paragraph 4 on page 4 of Mr. Shaw's brief there is a reference to transferring the emphasis of MOSST's activities into the area of R & D, as co-ordinators and advisers, rather than being concerned with statistical information and budgetary information.

Do you not think that in order to act effectively in the capacity you suggest, they do of necessity require budgetary and statistical information?

**Mr. Shaw:** Yes. I am not suggesting that they should not sit in on the preparation of the budgets, and afterwards, at the implementation stage; and they should be able to call forward the statistics they need. This does not appear only in our brief. According to my reading of the evidence, it seems to me that there was a long period, one day, of questioning of MOSST's representatives as to why it could not produce this kind of figure and that kind of figure, and prove this kind of project and that kind of project, and I had a feeling that the two areas the committee was dealing with were already rather well covered. In writing our brief I therefore brought that point out.

**The Chairman:** You may have given a wrong interpretation to the proceedings at that time. We were exactly of the same view, namely, that MOSST should not reproduce, as I said at that time, I remember, with less explanation, what Statistics Canada was already producing. What we were suggesting to MOSST was that they should present a science budget display in terms of the estimates and in terms of proposed expenditures, and that is something quite different, because Statistics Canada cannot do that. Perhaps the members of the committee have not heard about this yet, but we understand that the Minister of Science and Technology has agreed to do this, and that we will have this science budget display tabled in the house in separate form for the next estimates. I think that this will fill a gap. I also understand that as a result of this new activity of MOSST they will put less emphasis on publishing figures already produced by Statistics Canada.

**Mr. Shaw:** I think, Mr. Chairman, that that is exactly in line with what we are recommending, and I, for one, am delighted.

**Senator Lang:** On page 3, Mr. Shaw, you refer to MOSST again. You say:

I respectfully suggest that MOSST should start from Canada's strengths and needs and build on them.

What do you consider to be our strengths? Our needs are well documented, of course.

**Mr. Shaw:** Our strengths are in forestry, in iron ore, in nuclear energy, in steel from iron ore, and in all those secondary and tertiary industries that grow from the nature of Canada itself. As I said earlier, we should encourage the secondary industries that feed our primary industries, and the secondary industries that are fed by our primary industries, to make us as competitive as possible, and as productive as possible.

**Senator Lang:** In other words, our natural resource base. This is what you are referring to?

**Mr. Shaw:** Yes. Also there is some geographical base. I do not think it is an accident that we are good at bush aircraft, and those things that have grown from them, including aircraft generally. There are also communications, and energy in general. These things grow from the nature of Canada as a country. I must include fisheries also, of course. As we were discussing earlier, our hope is that the objectives will be broken down into those things in which we may be able to make the most progress.

**Senator Lang:** You do not feel that the "make and buy" policy has been so directed?

**Mr. Shaw:** No, I think it is more scattered.

**Mr. Nadeau:** I think I should add to this that what we had in mind there also, in talking about our strengths, was strength in organizations and processes. In other words, the Senate committee was recommending, for instance, a division of responsibility, taking the granting function away from NRC, where they have considerable strength, and giving it to a brand new organization, which is still not in existence, and our feeling was that it was perhaps better to strengthen existing organizations that were well established rather than dissipate their strength, by building something new which we do not know is going to work.

**Mr. Mordell:** Change for the sake of change.

**The Chairman:** We are of the same view. I am not personally in favour of change for change's sake. It seems to me there are occasions when changes have to be made. In any case, we are not going to go back to this. It is beyond our responsibility now.

**Senator Carter:** Could I just ask one supplementary question. When you say we should concentrate on our strengths, you are implying that our strengths are in the right places.

**Mr. Shaw:** Our strengths, like the strength of any nation, occur where you find them.

**Senator Carter:** If we have weaknesses, surely we should try to correct them.

**Mr. Shaw:** As long as there is a reasonable prospect that we can correct the weakness. I said earlier that I do not



believe that we should devote too much R & D to try and make a better transistor radio. I am sure the Japanese are going to be ahead of us for a long time yet because of their economy of scale and the markets available. So I would be selective in which weaknesses we go after.

**Senator Hicks:** Furthermore, there is a very great danger, if you are motivated only by strengthening weaknesses, that you will bring the whole state up to a respectable mediocrity. I believe strongly that we have to build upon our strengths, and so on. When we see something getting ahead of a national or international average, give it a boost.

**The Chairman:** We have to agree where they are, though.

**Senator Stanbury:** I am not sure, Mr. Chairman, whether this gentleman regards this as a strength or weakness, but if it is a weakness, perhaps it is one we should be paying attention to. You mentioned earlier that several, at least, of the largest engineering consulting firms in Canada are very active in foreign countries—in, I think, 40 different foreign countries. We are all pretty well aware of our problems in building our exports and covering our imbalance of trade. We have been talking principally about the things that we have to do within our own country and concentrating on many things that must be done here. Is there anything that we could be doing through the area of jurisdiction of this committee that would assist in giving a greater thrust to our engineering communities externally, and in the programs of support for the secondary industry we are having our problems with?

**Mr. Shaw:** Yes. I must declare a prejudice because the government has decided I have had too many birthdays and I am back into one of those firms I was referring to. I would say that the engineer tends to specify the familiar and, therefore, to encourage the export of engineering encourages it for secondary industry in Canada. Normally the skills we support are those skills that we have developed in the consulting engineering field because they are related to Canada's strength. Here you will find the consulting engineer is usually skilled in those things where Canada has strength.

On the other side of the coin, particularly with the developing countries, the client would like to see to it that he develops engineers that can carry on and gain expertise, and frequently calls for a training program for his engineers. In this area the consulting engineers do training work and, in fact, the Engineering Institute, with the assistance of the Industry, Trade and Commerce Department, is attempting to develop an educational program in project management, as a starter, which will provide that kind of training not only for Canadians, but also for engineers who may come to Canada under one of those contracts.

Dr. Mordell should not be allowed to speak on this subject because he is running it, and will talk forever.

**The Chairman:** I still have two questions concerning page 7, which I think should be covered because they are two important sections of the brief. The first is federal-provincial relations. You say that we should develop firm recommendations in this area at an early date. We have, as you remember, presented firm recommendations in this area in volume 3. Unfortunately, they have not been implemented yet. Would you have something specific in mind? We all agree, of course, that consultation and cooperation

at the federal-provincial level is essential, as you say in your brief. But where do we go from there?

**Mr. Mordell:** I guess what we are really asking here is what has happened as a result of the consultation between the federal and provincial governments in this area. We want to know the status quo. What is the situation? The publishing of these findings would enlighten us, and possibly the results of the findings at the present time would result in recommendations which your committee would make and which we and others could be made aware of.

**The Chairman:** Then in the last paragraph of page 7 you say:

... that while the overview in coordination function may be adequately performed by MOSST, the assessment of programs, their performance and results, is beyond the capability of a single group and can only be performed by individual departments and agencies.

First of all, how can you ask MOSST to have an overview and to coordinate, if they are not going to assess programs on their own, and the performance and the results?

**Mr. Shaw:** Mr. Chairman, if I may attempt to answer, I believe that if the material is produced by the expert, then a group of experts can assess that by remote control, and that the unclouded eye of the remote control assessors is most valuable.

All of us who have worked in the consulting engineering field have been amused when we have walked through a drafting room and looked at a drawing and asked, "Why did you do that?" When the poor devil who had been working over it for three weeks did not see it. The unclouded eye is enough to do it with the expertise that the unclouded eye has. I think MOSST has a very valuable role there without delving too deeply into detail.

**The Chairman:** We have assumed throughout our reports that the individual departments and agencies would assess their programs and the performance and the results. I think that goes without saying. What we have been saying is that there should be by MOSST, exactly the way you describe it now, an overview and assessment of the assessment. We are saying the same thing. We have never suggested that departments should not assess their programs.

Lastly, you say that the assessment of programs and their performance and results should be made public. That means, if a department assessed the programs and the performance and results, that you would like these assessments made by these departments to be made public.

**Mr. Shaw:** I did not write this one, Mr. Chairman. I think very frequently they are made public. The problem is the volume of paper that is made public. Sometimes things are made public before they are discovered.

**The Chairman:** I may be ignorant, but I have very seldom seen such publications. There have been some outlines in annual reports and other documents of the programs carried out for individual departments and agencies, but I have never seen an assessment of the results and the performance.

**Mr. Shaw:** The most recent one I can think of is the publication of the results of the Beaufort Sea project. That is only a week old.

**Senator Stanbury:** But is this related to the question which has been raised in a number of briefs—I forget whether it is contained in yours—as to the intramural work not being assessed by the peers of those involved? Is this one method of getting your peer assessment, by having the material published?

**The Chairman:** This has been proposed by another organization, but the peer system should apply to both extramural and intramural activities.

**Mr. Shaw:** Certainly it is in the Department of the Environment and I believe the National Research Council, from my reading. The Department of the Environment has an Environmental Advisory Council and there are councils in each of the disciplines, the most famous being the Fisheries Research Board. Those are all peer groups with frequently no one from the department on them.

**The Chairman:** But you are now asking for these peer groups to make their views public. Do you not believe that it would raise some problems as far as governmental intramural activities are concerned?

**Mr. Shaw:** Sometimes. The Environmental Advisory Council has the right to publish at any time. I think sometimes they prefer not to, if it is not necessary, in the expectation that that takes them deeper into the problem and that no one will begin to hide from them. But they do have that right, and they have published as far as I know.

**Mr. Moull:** Is it not better to make it open to the public by publishing in order that action and dialogue goes on so that the parties involved in the publication know what the public thinks and wants, and hence a method of publication seems to be more appropriate? Certainly it would have the risk of inhibiting some internal departmental activity participation and publication if it was known that the public would have a crack at it.

**Senator Godfrey:** It has been the experience in Sweden that they talk on the telephone, but do not write.

**Mr. Moull:** Do not let it go too far.

**Senator Godfrey:** Yes.

**Mr. Shaw:** If we are sitting behind the decision-maker as he makes his decision it becomes rather difficult.

**The Chairman:** We are not speaking of making the results of the research public, but making the assessment of the results public, which is something else. So you would argue that this would be a good move?

**Mr. Shaw:** I think so, with judgment. It is not always the right thing to do, but it is a good principle.

**Mr. Mordell:** Mr. Chairman, in my opinion one of the hardest things to do—and I have had experience with it—is to chop off a research program which has had its time or is pursuing red herrings. I am sure that in your inquiry you must have come across many who in principle are still refining the buggy whip, although it has been out of date for 40 years. I think, therefore, that some publication as to the activities of people, without getting into the details of the work, but as to the results and exposing that to the public, would be a good thing. It might strengthen the hand of the competent administrator who really feels, "We have spent 10 years on this project, but I cannot cut it because poor old Henry is there". The public pressure

might help him a little and it is very important to cut off the dead wood from a tree. It is as true in a research establishment as in horticulture.

**Senator Godfrey:** A joint committee is considering this very complicated problem and we could spend the remainder of the day on that subject.

**Mr. Shaw:** They should consider the effectiveness of the budget in doing just that without any help from anyone.

**The Chairman:** It was good to hear what the two bodies had in mind with respect to this particular recommendation.

**Senator Godfrey:** Although you had no responsibility for the brief submitted on May 19, 1972, I would like to get your reactions to it four years later.

**Mr. Shaw:** Possibly the gentlemen along the side are closer to it.

**Senator Godfrey:** I do not wish to ask those gentlemen who wrote the brief. At the bottom of page 7 appears the following:

Industry should not be encouraged to spend more on R&D than it is likely to find profitable, and we reiterate that the market "pull" rather than the research "push" should govern.

Then if we turn to page 9, again at the bottom of that page, the fourth line from the bottom, the following appears:

In industry, the process of innovation comprises a sequence of activities ranging from the conception of an idea, which may be the result of research, to the acceptance of a product in the market-place. Research is only a small part of this—and often the least costly. It follows that to "push" at the input or research end of the system is not nearly as effective as to "pull" at the output or market end. From this we would conclude that the current low level of R&D is more a symptom than a cause of the poor innovation performance of inquiry, and that the target expenditures and new research structures proposed in the Senate Report are an attempt to treat symptoms rather than root causes.

I would just like your comments?

**Mr. Shaw:** The preamble is, of course, what we have been saying here all morning. Unfortunately, I am not sufficiently familiar with what the senators said four years ago, but I think that states well what we have been saying today.

**Senator Godfrey:** Yes.

**Mr. Moull:** So in that sense the same thing is being said today as was said in 1972.

**The Chairman:** So, the so-called period of the continuum works, but in reverse, from being supply-push to demand-push.

**Senator Godfrey:** I might say I have been expressing the point that we cannot ram research down the throat of industry.

**Mr. Mordell:** Might I remind the distinguished committee of that old proverb or saw that necessity is the mother of invention, which is all we are really saying, is it not?



**The Chairman:** Exactly, and that is also all we are saying.

**Senator Lang:** Do both the Engineering Institute of Canada and the Canadian Council of Professional Engineers meet in plenary session once a year?

**Mr. Moull:** I will speak for the Canadian Council of Professional Engineers: Its board of directors meets twice per year, and at least twice per year the executive committee of the Canadian Council of Professional Engineers meets with the executive committee with the Engineering Institute of Canada. Similarly, the officers, usually the president and the general manager, of each body attend the meeting of the other, so there is complete integration of communication between the bodies.

**Senator Lang:** But the general membership in the institute is really corporate, is it not?

**Mr. Shaw:** No; there are five constituent societies, if you wish. In addition to the four you see here there is also the general member who has somehow slipped into management or administration.

**Senator Lang:** Do you have a plenary session such as the annual meeting of the Canadian Bar Association?

**Mr. Shaw:** Yes, we have one next month.

**Senator Lang:** What do you have on your agenda besides internal concerns?

**Mr. Shaw:** Technical papers, including next month a seminar on the subject of applied technology. Usually at the annual general meeting the papers tend to be general in nature because of the number of disciplines present, but the constituent societies go into more detail.

**Senator Lang:** Do you give press coverage? I am concerned about press coverage and publicizing your ideas on science policy or the direction of your profession. Only recently, for example, the Canadian Bar Association has suddenly come to life in this area. Heretofore, it was the conventional belief that as lawyers we should accept the laws as they come out and should learn them and be able to argue the pros and cons in the courts. But it has taken on a much more active role in the past few years. I wonder if that phenomenon is occurring among the professional engineers.

**Mr. Shaw:** I am reminded that at last year's meeting the Science Council came to us with their conservator society, and this was well covered by the news media. The trade and commerce people came to us with the use of Canadians in resource development, and the urban affairs people came to us with respect to their habitat program. That was all in last year's meeting.

**Mr. Nadeau:** Generally speaking, the engineering profession is taking an increasing interest in public affairs. I believe that is what you have in mind.

**Senator Lang:** Yes.

**Mr. Nadeau:** More and more at general meetings or sessions these subjects are being discussed. A couple of years ago the Association of Professional Engineers of Ontario, consisting of 45,000 members, had an open public seminar on air pollution. The public was invited and it was all generated by the engineering profession in Ontario. So we are taking a greater and greater interest in these matters and we are trying to publicize our views on them.

**The Chairman:** To what extent has this brief been circulated among the profession? I just want to know if the brief is simply the result of the work of a few people without consultation with the Institute or the Council, or otherwise. What was the procedure?

**Mr. Nadeau:** I can explain that. When the first news of the Senate committee's work was published we organized throughout Canada in the various provinces special committees which prepared themselves to respond to whatever was going to come up, and after publication of our first volume this was read widely by various groups throughout the country and, eventually, these various committees in the provinces sent their views in to a national headquarters and all this was put together by a national committee so that we had this reaction from all the provinces. Simultaneously, after briefs were prepared, they were redistributed throughout the provinces so that the membership at large had an opportunity to react to them. We can now say that what has been printed as our final briefs represent the consensus of the engineering profession.

**Senator Yuzyk:** Is the Council the overall general spokesman for the engineering community or is the Institute that spokesman?

**Mr. Nadeau:** It depends on what the subject is. On certain subjects the Council is the spokesman. If it is purely technical, then the Engineering Institute of Canada would be the spokesman, but there are many subjects like this one which involves both sides of the profession so we get together.

**The Chairman:** There is a common interest.

**Mr. Shaw:** So you have your spokesmen sitting in these two chairs here.

**Senator Yuzyk:** Who takes the general initiative on the cooperation?

**Mr. Moull:** It depends on the topic. Usually it is a matter of quick collaboration between the two bodies.

**Senator Carter:** What is the manpower situation for engineers? A few years back, just when we were holding our original meetings, there was a surplus of engineers for a while and they had a hard time finding jobs. What is the position now, and what is your projection for the future? Are we all right?

**Mr. Moull:** The last survey, taken at the end of 1975, indicated that unemployment of engineers was something in the order of 2.3 per cent.

**Mr. Nadeau:** No, it was less than that.

**Mr. Moull:** Was it less than 1 per cent?

**Mr. Nadeau:** It was less than 1 per cent, yes.

**Mr. Moull:** So there was a fraction of engineers who appeared to be unemployed.

**Mr. Nadeau:** We have an organization called the Canadian Engineering Manpower Council which does surveys and studies in that area. The current assessment of the Council as to supply and demand is that they are reasonably well balanced.

**Senator Carter:** Have you made projections for the future, for the next five to ten years?

**Mr. Nadeau:** We are trying very hard to do this, but it is extremely difficult. On the supply side we have a pretty good idea how many we are going to produce. The government will decide how many we will import. On the demand side, however, it becomes quite hard because there are so many unknown factors which we cannot possibly measure. We are trying to devise better ways of predicting demand for the short term—that is, three or four years. We cannot do it for any longer than that.

**Senator Carter:** How many per year are you producing?

**Mr. Nadeau:** Roughly 4,000 engineers per year in Canada.

**Senator Carter:** And we have a total of 85,000 now.

**Mr. Moull:** They are coming into the registered body across the country at the rate of about 4,000 per year, which is about 5.5 to 6 per cent per year.

**Senator Yuzyk:** How many do we lose to the United States and other countries annually?

**Mr. Nadeau:** We have no way of measuring that, because we do not keep track of people moving out of the country. We know how many people come in, but not how many go out.

**Mr. Shaw:** The 85,000 are, of course, registered engineers. Some may keep their registration when they cross the border, but that would not be a big number.

**Mr. Kerr:** To further elaborate on the point about future requirements, the Canadian Council and the Institute in collaboration with the Canadian Engineering Manpower Council with the participation and support of the Science Council and the National Research Council are in the process now of planning an engineering and manpower conference in Edmonton next spring, at which time we hope to be able to find out what our future demands will be and how we will fill those requirements.

**Mr. Moull:** Supply, demand and utilization of technical manpower is a vast subject which involves not only engineering people *per se* but also technicians and technologists related, para-professionals. This is currently part of our active discussions within the Canadian Council with other bodies, one of which is the technicians and technologists organization. It will be a big part of its conference next spring in the overall picture of the supply, demand and utilization of technical manpower.

**Senator Carter:** You say that less than one per cent of engineers are unemployed. Do you know how many are employed in professions other than engineering?

**Mr. Moull:** I would be guessing, but it is probably 50 per cent or more.

**Mr. Nadeau:** By the nature of the jobs which engineers fill in industry, particularly, they soon progress into something that is no longer engineering, or at least the engineering content of their job diminishes gradually and they become managers. This is a natural progress. I do not know what your question referred to. You mean these people practise engineering for a while and then get out of it?

**Senator Carter:** You have a small rate of unemployed engineers, but I was wondering how many of them are employed in other jobs, other than engineering for which they were trained.

**Mr. Moull:** You have to define what is engineering. In my own case, I am a registered professional engineer in the Province of Ontario. I am a manager for Ontario Hydro. I am very close to engineering type of work. I have a large number of engineers working for me. But I manage; I do not do engineering *per se*. This applies to a great many people.

**Senator Carter:** I was thinking in terms of unrelated work.

**Mr. Shaw:** One hundred per cent of those of us representing the engineering profession here today are not in the technological detail of engineering, but all of us do work related to it.

**Mr. Moull:** I would say well less than 50 per cent are in the pure technical design type of engineering.

**Senator Godfrey:** I should like to refer to a statement in your brief of January 30th, 1974. You were talking about the composition of the proposed Science and Engineering Council, and you refer to the fact that you do not agree with the recommendations as to the composition in the Senate report. I must confess I do not know what those recommendations are at the moment. I have forgotten them.

**Mr. Shaw:** I remember that.

**Senator Godfrey:** The indication seems to me to be that you believe this Council should have a chairman who is a technical man, and that the 28 ordinary members should all be oriented in that direction.

**Mr. Shaw:** I do not think that is what it says, and certainly that is not what it means.

**Senator Godfrey:** You believe there should be room for lay people.

**Mr. Shaw:** The committee endeavoured to set up specific numbers from this discipline, and other specific numbers from that discipline, and we thought the relationship should be rather more loose than that, in order to give the ability to select.

**The Chairman:** I think one of the main objections they had to our proposal was to have social scientists sitting on the Council.

**Mr. Shaw:** No, we do not object to that either. It was just that you said there should be one-third, or some such proportion, from this discipline, and another third from somewhere else, and so on.

**The Chairman:** These were, of course, guidelines.

**Senator Godfrey:** You say that 28 ordinary members from the sciences should be appointed after consultation with the appropriate organizations. I got the impression that you meant they should all be representatives of the various sciences. Is that not the case?

**Mr. Shaw:** No. You will find, reading on down there, that it does include social scientists.

**Senator Godfrey:** Well, but I thought you meant that the general public should be represented by lay people.

**Mr. Shaw:** No, it was just that we thought that selection should be rather more informal.



**The Chairman:** Thank you very much. Your presentation has been very useful to the members of the committee, and we will report in due course, but as quickly as possible. I hope that this time we will take your views even more carefully into consideration than we did the last time.

**Mr. Moull:** Mr. Chairman, we have welcomed the opportunity of being here and we appreciate your statement

that you will take our recommendations into consideration.

**Mr. Shaw:** Mr. Chairman and honourable senators, may I say, very briefly, that I have enjoyed every minute of it.

**Senator Godfrey:** We got that impression.

The committee adjourned.

## APPENDIX "36"

BRIEF TO  
THE CANADIAN SENATE SPECIAL COMMITTEE ON SCIENCE POLICY  
FROM  
THE CANADIAN COUNCIL OF PROFESSIONAL ENGINEERS  
AND  
THE ENGINEERING INSTITUTE OF CANADA  
OTTAWA, JANUARY 20, 1976

## INTRODUCTION

This Brief is submitted in answer to an invitation extended by the Senate Committee to non-governmental organizations to comment on the three specific areas in which the Committee intends to resume its 'watchdog role'

The Engineering Institute of Canada and the Canadian Council of Professional Engineers are grateful for this opportunity to present the views of the engineering profession on these important matters and are at the disposal of the Senate Committee for further discussion and comments at any time.

The Engineering profession is greatly concerned, however, that it has not seen any evidence that the Senate Special Committee has acknowledged, or even more importantly taken into positive consideration some of the strong views put forward by the profession in its response to the recommendations of Volumes II and III of the report entitled 'A Science Policy for Canada'; it is concerned that the Committee apparently intends to monitor the implementation of its original recommendations, without any attempt to incorporate modifications proposed by the engineering profession—and by other responding organizations.

## FUTURES RESEARCH PROGRAMS

The Engineering profession is in general agreement with the proposal outlined in a letter addressed to the President of the Institute for Research on Public Policy by Mr. C. R. Nixon, on April 1, 1975, and with the role of the Senate Special Committee as outlined in the Committee's first report dated July 10, 1975. We fully endorse the Committee's view that there is a "need for co-ordinated national networks of futures research and information".

We believe that futures research financed by the Government and the development of policy options should have the following characteristics:

- (a) It should be carried out not only as an adjunct to the establishment of national goals and priorities, but as an essential contribution both to these processes and to other short-term planning activities.
- (b) It should encourage and be receptive to inputs from outside knowledgeable sources and not be carried out in isolation.
- (c) It should be characterized by continuity and dynamism; its findings and projections should be published on a regular basis, with up-dating at reasonable intervals and with distribution to the public at large.
- (d) The regularly published report should include observations on the appreciation of the future provided by other organizations, in order that 'coordination' may be achieved in fact.

- (e) The report should also emphasize the inherent hazards involved in such studies and clearly indicate confidence limits and possible alternatives.

Briefly, the engineering profession favours the development of a 'down to earth' network of futures research programs under government leadership as a useful tool for both government and private sector researchers, planners and decision-makers.

## A SCIENCE POLICY FOR CANADA

*General Principles*

The Engineering profession wishes to re-affirm the views expressed in the briefs submitted to the Senate Special Committee on Science Policy by the Canadian Council of Professional Engineers on May 10, 1972, and January 30, 1974, in response to the Report of the Committee, entitled 'A Science Policy for Canada'. Copies of these briefs are attached.

We particularly wish to emphasize the urgent need to establish clearly identified national goals and priorities, dynamic and flexible targets and strategies and a renewed feeling of mutual respect and confidence between industry and government. We also wish to reiterate our belief that every attempt must be made to build on existing strengths and to ensure that these strengths are not dissipated or eroded—all in preference to replacement by new but untried processes or organizations.

*Discussion*

*Objectives*—We believe that the failure of the Government to maintain, let alone increase, the allocation of resources to research and development in the natural science and engineering field in recent years and its recent decision to continue this policy during the current period of restraint are due in large measure to the absence of clear objectives.

It is obvious that the general public and their elected representatives will not support R&D activities unless the objectives and anticipated benefits of such activities are clearly stated in terms easily understandable.

The Engineering profession wholeheartedly agrees with the Minister of State for Science and Technology in his statement to the Special Committee that "the amount of curiosity-oriented basic research performed should probably reflect the wealth of a country in so far as it is directed at a search for new knowledge, while reflecting national needs in so far as it is directed at the training of skilled personnel, and that the amount of applied research and development, effort should be related directly to the solution of national problems."

*Goals and Priorities*—We have stated our belief that the establishment of clearly identified goals and priorities is the most essential and urgent problem. Once these are defined, it will become possible and practical to determine related basic needs and to allocate appropriate resources to R&D activities.

For instance, it is our view that the following areas should be given prime consideration at this time:

- (a) Energy with the objective of achieving self-sufficiency during the foreseeable future;
- (b) Food production with the accent on protein;
- (c) Development of secondary industry;
- (d) Transportation and communications;
- (e) Protection of the environment;
- (f) Conservation, utilization and development of Canadian human and natural resources.

We can see enormous problems as well as great benefits within these areas of activities and urge that the Committee press the Government to give urgent and serious consideration to our recommendations.

*Industrial Strategy*—The Engineering profession has noted with satisfaction that the Government has apparently started to recognize the importance of the industrial aspects of science and technology through the adoption of the 'Make or Buy Policy', the establishment of the Inter-departmental Committee on Industrial Technology Policy, chaired by MOSST and the Inter-departmental Committee on Industrial Policies and Strategies, chaired by I.T.&C.

We also note that the 'Make or Buy Policy' is currently being reviewed and that the possibility of extending its application is being examined, that a review of industrial research and development incentive programs is under way and that the recommendations of a report on the availability of risk capital for technological innovations are under active consideration by MOSST.

We believe these are steps in the right direction, but much more effort is required to bring Canada in line with other industrial nations in the proportion of government R&D expenditures allocated to industry and to redress the imbalance which continues to exist in this country and which favours so highly 'in-house' R&D.

We also hope that the results of the deliberations on industrial rationalization and strategies will be made known in due course and that our profession will be provided with opportunities to contribute to the discussion.

In our opinion, Government procurement and R&D expenditures should be made substantially more consistent, relations between government and industry should be greatly improved and greater user involvement in the decision-making process relative to the allocation of R&D resources, both in-house and in industry, is required.

We also feel that the Special Committee should, in its review, be less concerned with mechanisms and concentrate its efforts on short-term objectives.

*Research Grants and Scholarships*—The Engineering profession has previously expressed its view that every attempt should be made to build on existing strengths and to ensure that these strengths are not dissipated or eroded.

We note the long delay in implementing the government decision to transfer the granting functions of the National Research Council to a proposed new Natural Sciences and Engineering Research Council and question the desirability of proceeding with this implementation at this time.

As mentioned in our previous Brief, dated May 19, 1972, the National Research Council is one of the few organizations in the world with an operating role at the interface of research in the three sectors—university, government and industry—it has displayed a willingness to stimulate a more dynamic interaction between the three sectors.

We believe that the current movement within N.R.C. towards greater involvement in engineering and applied research should be and can be accelerated and that it would be preferable to concentrate on improving a well established structure rather than dissipating its strength by wholesale transfer and abolition.

Increasing industrial representation on various N.R.C. Committees, particularly on the grants and scholarships committees, could provide a number of benefits. The committees themselves would be more aware of and receptive to 'real' needs, they would better appreciate the relevance of supported engineering and applied research programs, and would become more interested in following such programs and in assessing the results thereof."

*Federal-Provincial Relations*—We do not believe that meaningful consultation and active cooperation between the Canadian Government and the provinces have been achieved as yet in the area of science policy.

Having previously expressed the view that such consultation and cooperation is essential, we would urge that the Special Committee review the current situation and publish its findings with firm recommendations at an early date.

## ASSESSMENT OF EXPENDITURES AND PROGRAMS RELATED TO SCIENTIFIC ACTIVITIES

The Engineering profession agrees that a continuous overview of the scientific activities of departments and agencies and a periodic assessment of expenditures and programs related to such activities are necessary.

We believe, however, that while the overview and coordination function may be adequately performed by MOSST, the assessment of programs, their performance and results, is beyond the capability of a single group and can only be performed by individual departments and agencies. On the other hand, the results of such assessments should be made public so that the public may judge to what extent objectives and anticipated benefits have been achieved.

Submitted on behalf of  
the Engineering profession in Canada  
by  
THE CANADIAN COUNCIL OF PROFESSIONAL  
ENGINEERS  
and  
THE ENGINEERING INSTITUTE OF CANADA  
January 20, 1976



## APPENDIX "37"

ONTARIO ENGINEERING  
ADVISORY COUNCIL  
RECOMMENDATIONS  
JULY 5, 1976

1. The Ontario Engineering Advisory Council in seminar session, being convinced that productivity improvement must become a national goal, a pervasive ethic, and being further convinced that the Federal Government is uniquely capable of giving leadership in such a program for attitudinal change, recommends to the Federal Government, through the Office of the Prime Minister, the formation or designation of a National Centre for Productivity in which, or by which, representatives of Government, Labour, Management and Technology can contribute usefully and effectively to the development and inculcation of new philosophies and mechanisms for productivity improvement in and by all of the contributing groups. In such an endeavour, the Ontario Engineering Advisory Council would encourage its sponsors and all members of the technological community to work with any designated organization.

2. The Ontario Engineering Advisory Council in seminar session recommends to the respective councils of the Canadian Council of Professional Engineers, the Engineering Institute of Canada and its constituent Societies, and the Canadian Council of Engineering Technicians and Technologists that they endorse and support the concept of Federal leadership in productivity improvement through the formation or designation of a National Productivity Centre which would bring together representatives of Government, Labour, Management and Technology; it recommends further that this endorsement and support be made known not only directly to the Office of the Prime Minister, but through the normal Federal Agency relationships of the respective organizations.

3. The Ontario Engineering Advisory Council in seminar session, being convinced that a national goal of productivity improvement must have a practical embodiment in the Province of Ontario, recommends to the Provincial Government, through the Office of the Premier, immediate implementation of the principles enunciated by the Premier himself in August 1975, "... I propose that we establish such a body, through a series of task forces, for

Ontario, representing government, labour, and business to deal specifically with the substantive matters relating to productivity." In such a program, the Ontario Engineering Advisory Council sees a special opportunity for contribution on the part of the technological community and, consequently, recommends that it be identified specifically as an appropriate partner of "government, labour and business". To this end the Council offers to use its full influence toward direct support by the various organizational elements of the technological community.

4. The Ontario Engineering Advisory Council in seminar session recommends to the respective councils of the Association of Professional Engineers of Ontario, the Ontario Association of Certified Engineering Technicians and Technologists, and the Ontario Region of the Engineering Institute of Canada that they endorse and support provincial initiatives in productivity improvement through the establishment of task forces in specific areas, each of which would contribute to a provincial co-ordinating body; it recommends further that this endorsement and support, together with details of any initiatives particular to the individual organizations, be made known not only directly to the Office of the Premier but through the normal provincial ministry relationships which now exist.

5. The Ontario Engineering Advisory Council in seminar session, recognizing not only the need for national goals and provincial action in productivity improvement but the need for bringing appropriate emphases to the local or 'grass-roots' level, recommends to the councils of the Association of Professional Engineers of Ontario, the Ontario Region of the Engineering Institute of Canada, and the Ontario Association of Certified Engineering Technicians and Technologists that they mount individual, joint, or co-operative 'productivity programs' to be carried out through their respective local Chapter or Branch systems; it recommends further that any such programs should be appropriately co-ordinated through a steering committee, and that they be undertaken with the active co-operation and involvement of the twenty-one regional offices of the Ministry of Industry and Tourism.







Government  
Publications

FIRST SESSION—THIRTIETH PARLIAMENT  
1974-76

**THE SENATE OF CANADA**  
**PROCEEDINGS OF THE**  
**SPECIAL COMMITTEE OF THE SENATE ON**  
**SCIENCE POLICY**

The Honourable MAURICE LAMONTAGNE, P.C. *Chairman*

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**Issue No. 22**

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**TUESDAY, SEPTEMBER 7, 1976**

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**Twenty-second Proceedings on**  
**the Study of Canadian Government and**  
**other expenditures on scientific activities**  
**and matters related thereto.**

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(Witnesses and appendices: See Minutes of Proceedings)

THE SPECIAL COMMITTEE OF THE  
SENATE ON SCIENCE POLICY

The Honourable Maurice Lamontagne, P.C., *Chairman*

The Honourable Donald Cameron, *Deputy Chairman*

and

The Honourable Senators:

Asselin	Hastings
Bélisle	Hicks
Bell	Lang
Blois	Manning
Bonnell	Neiman
Bourget	Riel
Buckwold	Robichaud
Carter	Rowe
Giguère	Stanbury
Godfrey	Thompson
Goldenberg	van Roggen
Grosart	Yuzyk
Haig	

27 Members

(Quorum 5)

# Order of Reference

Extract from the First Report of the Special Committee of the Senate on Science Policy, presented on July 10, 1975 and printed as an Appendix to the Minutes of the Proceedings of the Senate of that day, and adopted by the Senate on July 24, 1975:

"The Committee, therefore, recommends that it be authorized to consider and report on Canadian government and other expenditures on scientific activities and matters related thereto;

That the Committee have power to engage the services of such counsel and clerical personnel as may be necessary for the purpose of the inquiry;

That the Committee have power to send for persons, papers and records, to sit during adjournments of the Senate and to report from time to time; and

That the Committee be authorized to print such papers and evidence from day to day as may be ordered by the Committee."

Robert Fortier,  
*Clerk of the Senate.*



# Minutes of Proceedings

Tuesday, September 7, 1976  
(36)

Pursuant to adjournment and notice the Special Committee of the Senate on Science Policy met this day at 2:35 p.m., the Chairman, the Honourable Senator Lamontagne, presiding.

*Present:* The Honourable Senators Bell, Cameron, Carter, Godfrey, Hicks, Lamontagne, Lang and Yuzyk. (8)

*In attendance:* Mr. Philip J. Pocock, Director of Research and Mr. Jacques W. Ostiguy, Chief of Administration.

The Committee resumed consideration of its Order of Reference dated July 24, 1975 relating to the study of Canadian Government and other expenditures on scientific activities and matters related thereto.

The following witnesses were heard:

*From: SCITEC—The Association of the Scientific, Engineering & Technological Community of Canada:*

Dr. Peter A. Forsyth, President;

Dr. H. R. Wynne-Edwards, Vice-President;

Dr. Michel Bergeron, 2nd Vice-President;

Mr. J. Y. Hartcourt, Executive Director.

*National Committee of Deans of Engineering and Applied Science:*

Mr. G. W. Frennel,  
Dean, Faculty of Engineering,  
McGill University.

Mr. D. J. Laurie Kennedy,  
Dean, Faculty of Engineering,  
University of Windsor.

*The Chemical Institute of Canada:*

Mr. J. A. Morrison, President;

Mr. T. H. G. Michael, General Manager.

*Association of Consulting Engineers of Canada:*

Mr. P. T. Beauchemin, President;

Mr. D. Newman, Past Chairman,  
R & D Committee;

Mr. Ian McCaig, Incoming Chairman,  
R & D Committee;

Mr. H. R. Pinault, Managing Director.

Dr. Forsyth, Dean Kennedy, Mr. Morrison and Mr. Beauchemin each made an opening statement. The witnesses then answered questions put to them by Members of

the Committee.

On Motion duly put it was *Agreed* that appendix I of the opening statement by the representative of SCITEC; the position paper entitled "The Funding of Engineering Research in Canadian Universities" presented by the National Committee of Deans of Engineering and Applied Science; the two briefs received from the Chemical Institute of Canada and the brief received from the Association of Consulting Engineers of Canada be printed as appendices to this day's Minutes of Proceedings and Evidence. (See appendices Nos. "38", "39", "40", "41" and "42")

At 5:30 p.m. the Committee adjourned until 9:30 a.m., Wednesday, September 8, 1976.

ATTEST:

Patrick Savoie,  
Clerk of the Committee.

# The Special Committee of the Senate on Science Policy

## Evidence

Ottawa, Tuesday, September 7, 1976

The Special Committee of the Senate on Science Policy met this day at 2.35 p.m. to consider Canadian government and other expenditures on scientific activities and matters relating thereto.

**Senator Maurice Lamontagne** (*Chairman*) in the Chair.

**The Chairman:** Honourable senators, due to a reorganization of our original plans we have a heavy schedule for this afternoon. As you know, we were supposed to meet with SCITEC this morning. Because their representatives could not be with us, they had to be rescheduled for this afternoon. It means this afternoon we have four groups, which, unfortunately, are too many.

I would propose that we begin by hearing representatives from SCITEC, and the National Committee of Deans of Engineering and Applied Science, and that we should question them until about 4 o'clock. Then we would hear from the consulting engineers and the Chemical Institute of Canada. Is that acceptable?

**Senator Hicks:** Agreed.

**The Chairman:** We have the representatives of the two first associations. On your behalf I want to welcome them. The President of SCITEC has an opening statement to make, which will be printed as part of our proceedings today. He also has an appendix, which is a brief summary of the history of SCITEC, and I think, we should print it as well.

**Senator Hicks:** Is this before us in our documents now, Mr. Chairman?

**The Chairman:** Yes.

**Senator Hicks:** Your opening statement, as well?

**The Chairman:** Yes. We have just received it.

We also have a brief from the National Committee of Deans of Engineering and Applied Science and I would suggest that it, too, be printed as an appendix to our proceedings.

**Senator Hicks:** May we have our visitors identified, Mr. Chairman?

**The Chairman:** They will be in a moment. You are always one step ahead of me.

**Senator Hicks:** I beg your pardon.

**The Chairman:** I would now invite the President of SCITEC, Dr. Forsyth, to not only make his opening statement but to introduce any members of his delegation that he wishes to at this stage.

**Senator Godfrey:** It would be helpful if they would not only explain their position but tell us what they do outside SCITEC.

**The Chairman:** Let us hear the statement first.

**Senator Godfrey:** I am talking about the identity of the individual witnesses. I know that Dr. Forsyth is President of SCITEC, but I have not got a clue what he does otherwise. We were three-quarters through this morning before I discovered that one of the witnesses worked for Hydro. It is of interest to know.

**The Chairman:** You wish to discover any conflict of interest?

**Senator Godfrey:** Right.

**Dr. Peter A. Forsyth, President, Association of the Scientific, Engineering and Technology Community of Canada:** My name is Forsyth and I happen to be a professor of physics at the University of Western Ontario. Our first vice-president is Dr. H. R. Wynne-Edwards. I suppose I can say he is a professor of geology at the University of British Columbia. We also have with us Dr. Michel Bergeron, a medical researcher at the University of Montreal, and Mr. J. Y. Harcourt, our executive director.

If I may go straight into the opening statement, we tried to summarize it for you. We felt that there would be at least three aspects of SCITEC that should be reviewed at this committee. The first of these, of course, is the history of where we came from. Second, is SCITEC's attitude to the present science scene, which I hope to cover briefly in these remarks. The third aspect is the question of where we go in the future and what we can do to influence the development of science in Canada. As I point out, we hope that these aspects will be the subject of discussion after these opening remarks.

Let me start by saying that SCITEC is both an association of scientific societies and an association of individual scientists. We have some 27 member societies in their own right, plus a number of umbrella associations, which include scientific societies among their membership. In all the number of scientific societies that owe some allegiance to SCITEC is over 60. We also have a category of individual membership, and we have some 350 individual members of SCITEC.

SCITEC owes its existence to the widespread belief that science is an important component of modern society and will become even more important in the future. The growth of science over the last 100 years has forced increased specialization and the creation of a large number of separate disciplines. The individual scientific technological and engineering societies in Canada quite properly exist to promote these individual scientific societies and their disciplines. The major problems facing Canada, its people and its industries are multi-disciplinary in nature,



and the proper place to discuss these problems is in a forum to which scientists of all disciplines can contribute. And it is not only the scientists who can contribute to these discussions. Parliamentarians and members of the public should also participate. So an essential function of SCITEC must be communication—communication, first, among scientists, for it must be obvious that many scientists are ill-informed about the major problems that face society today.

Communication with parliamentarians, because it is only in this way that the parliamentarians will be made aware of the potential that exists within the scientific community for the solution of the problems. Communication with the public, in order that there will be public support for the utilization of science in the service of the nation. And of course, no improvement in Canada's economic or social condition will come about without the active involvement of industry and of the universities.

Communication in Canada is made difficult by geographic factors, but the problem is compounded for the scientific community. The individual scientific societies in the U.S.A. are larger, wealthier and more active than their Canadian counterparts. In order to survive professionally an active Canadian scientist must belong to at least one and often to two or three societies in the U.S.A. He will be persuaded to join a Canadian society only by appealing to his sense of patriotism. Much of science is international but science will be brought to bear on Canadian problems only if these problems are discussed within the Canadian scientific societies and between those societies. These are the difficulties that SCITEC faces in trying to improve communication among scientists and between scientists and the public. But substantial progress has been made and we are working to the limit of our present resources. We are also working to increase our resources so that we can do more.

I am sure that you will have received statistical information which shows the decline over the last few years of scientific, technological and engineering activity in Canada. Naturally we are concerned about this decline. Science is a delicate organism. It takes many years to develop a significant, scientific capability and only a few years to destroy it. We are also worried about the future. The problems of energy, food, the environment and economic and social order which we now face are going to grow steadily more complex and new problems involving shortages of critical resources will arise. The quality of Canadian life for our children and our grandchildren will depend very much on the quality of the science and engineering that is done in the next few years. SCITEC cannot solve these problems but it can contribute to the solutions by generating the appropriate discussions, both within and outside the scientific community. Such discussions can only be the starting point. Discussions about science and technology are useful only if they serve to direct scientific and technological activity in the appropriate directions. Of course, to be fruitful there must be adequate support for the scientific activity.

In discussing the funding of science we are only adding our support to the many individual arguments that you must have heard previously, but I would like to add one further point. SCITEC is a collection of scientists. We are all members of individual disciplinary societies to which we make voluntary contributions of time and money. We choose also to make similar contributions to SCITEC. We do this not in the hope of increasing our salaries, or our

pensions or our leisure time, but for the sake of the survival of science. Indeed, if we are successful, one certain result is that each scientist will have less leisure time. But we believe that the survival of science in Canada is crucial to the survival of the Canadian way of life.

The survival of science is not an end in itself, but we believe that its survival is closely related to the survival of the human race. Here in Canada, while we are still a comparatively affluent nation, we have the opportunity to exploit science for the benefit of our industries and our people. SCITEC is anxious to see that that opportunity is not lost.

These remarks have been brief, but we hope they will serve to show that we share with you a common concern as to the future of Canadian science and technology, and that SCITEC will have a major role to play in developing that future. These remarks have been brief because we hope to discuss this role as fully as possible in the question period.

If any stimulus is necessary I would just mention that of particular concern to us for the future is the question of parliamentary committees which could interact with the scientific community's interaction between the scientific community and the Science Council. There are the institutional problems that arise in terms of discussion of science in Canada and, of course, the central problem of the public awareness of science and the role that could be played in the arousal of that awareness by the media and other organizations in Canada of the general nature of the association for the advancement of science, which does not now exist in Canada, but is a role which SCITEC hopes to fulfil in the future.

**The Chairman:** Thank you very much. Now we will hear from the National Committee of Deans of Engineering and Applied Science. Dean Kennedy will speak on behalf of that committee and will introduce his delegation with proper identification.

**Dean D. J. Laurie Kennedy, Faculty of Engineering, University of Windsor:** Thank you, Mr. Chairman. I am the Chairman of the National Committee of Deans of Engineering and Applied Science this year. My regular post is with the University of Windsor, where I am dean of engineering. Two of my colleagues are with me today, Dr. Callaghan, dean of engineering at Concordia University, and Dr. Farnell, dean of engineering at McGill University. The National Committee of Deans of Engineering and Applied Science is comprised of some 30 deans of engineering faculties across Canada. We meet about twice a year to discuss problems of mutual interest. We have an executive committee, which is very large and consists of a chairman and a secretary. From time to time we assign to members, to ourselves, tasks such as the position paper, Mr. Chairman, with which you have been presented, on the funding of engineering research in Canadian universities, in which Dr. Farnell had a major role to play.

This report, "The Funding of Engineering Research in Canadian Universities", resulted from a meeting held in Ottawa two years ago, in October 1974. The report itself was drafted in early 1975 and was presented to the National Committee in Halifax in June of that year. As you see by the date on its cover, it was finally printed in September of 1975. Because it was directed to a rather wide audience, it has been written in general terms and has been distributed to a large number of federal government departments as well as to every provincial government in Canada. Some of the explanatory statements that you see in that document

will, no doubt, be self-evident to members of this committee, but have been put there because of their general broadcast. We have already had an opportunity to discuss this document with the management committee of the National Research Council.

Perhaps first of all we should say that it is rather surprising for us as engineers to be here before the Special Committee of the Senate on Science Policy because, Mr. Chairman, I would point out that we are not scientists, we are engineers. One of the first things we would like to do is try to distinguish between engineering research and research in science. Perhaps as latecomers to research activity in Canadian universities we fell into the trap, if it is a trap, of comparing ourselves to our science colleagues and tended to follow the paths that they led in the 1950s and through the 1960s. In those stages of our engineering research in Canadian universities we seemed to be more concerned with what I might call the underpinning of engineering activity rather than the design, synthesis and development of machines, products and systems which form the basis of industry.

On page 5 of our report, Mr. Chairman, it states that the function of engineering is usually noted to include the application, with judgment, of the findings of the natural and mathematical sciences in the development, for the advantage of man, of economic methods of utilizing the materials and forces of nature. We note in this definition that, in fact, science is a part of the basis of engineering, but is not engineering. We note also that development is an integral part of engineering research and should be relevant or directed toward tangible goals and must, of course, look for creative activity.

In project Hindsight, conducted in the United States several years ago, a review of 700 defence-oriented developments in the United States revealed that 2 per cent of these were on the basis of scientific breakthrough; 9 per cent were based on applied science, which, by the way, is part of our name; and 91 per cent were based on technology or engineering. It has been suggested by others, Mr. Chairman, more learned than myself that basic scientific research is essentially a passive and a contemplative activity attempting to discover what already exists. It produces knowledge and no tangible results. I suggest to you that engineering research should be creative and that it is directed towards tangible results.

**The Chairman:** I remember that quotation.

**Dean Kennedy:** If I may take a somewhat homely example, I am sure that every person present in this room is familiar with an airfoil and what it is supposed to do. We are all aware that the scientific principle first developed by Bernoulli says that if you have an area of high velocity the pressure is less. Therefore, we design airfoils with such a shape that the upper surface causes the air to flow more quickly. Therefore, the pressures are less and a wing so built, if it is properly engineered, will lift an aircraft into the air. So the scientific principle is very simple—to design and build that shape which will function and to be concerned about the efficiency of such airfoils is an engineering problem. By developing proper airfoils we can develop aircraft which better serve our function, and this, Mr. Chairman, is the role of engineering.

We wish to further point out that universities, as you are well aware, are different from other parts of the educational system. We are concerned, as are our scientific colleagues, with the creation of knowledge as well as with its

dissemination. As engineering educators we are also concerned that our knowledge is relevant to societal needs, and because of this in our undergraduate curriculum we spend much time at what I might call clinical sessions, where we become involved in real world problems.

We also would like to extend this concept of being involved with real world problems into our research. We are vitally concerned that our engineering research should be more relevant and deal with the problems which are of concern to the society and that will help make Canada or Canadian industry more competitive in world markets. We recognize that presently a significant component of our faculties in engineering has fixed staff, fixed staff both from the point of view of numbers and from the persons that we have. We have little opportunity to change staff, perhaps because of some outmoded tenure policies of some of our universities. Because of this it gives us some difficulty, then, to suggest a major change in the emphasis of engineering research at our universities, but we are convinced that this must be done. We must move more away from scientific research towards that relevant to the needs of society, the development, the synthesis and the design.

Presently, in most engineering faculties the greater portion of our research moneys comes through the NRC grant program. We are now coming to the stage where contract research is playing a greater and greater role and we see more and more need for this. We must echo the words of the Chairman of the Science Council, Joseph Kates, who lately has said that he sees the need for more engineering research. We would further suggest, Mr. Chairman, that presently, although they are, by far not underworked, engineering faculties are underutilized and that their expertise in a great many areas is not taken advantage of by our industrial communities. We have, as a matter of fact, in the latest edition of the *Financial Post* an article stating that "academics flunk industry for not exploiting research and development in campus labs."

We would welcome a change in orientation so we could partake more in industrial problems. In this regard, Mr. Chairman, at our last meeting in Jasper in June of this year we recommended the establishment of a government-industry-university committee to examine the possibility of developing the interaction between these three organizations so that research that we could do would be more relevant.

We have written a letter to the Honourable C. M. Drury on this matter and he has already appointed a Dr. Livia Thur of his staff to this committee. We see this as a first step in a development which should lead to better interaction between industry, government and university, and dealing with problems that are relevant to our industry's needs.

We believe further that the government should move with some haste to establish the new granting councils that were proposed some time ago. I do not know why these councils seem not to be moving forward and that steps seem to be taken only very slowly. At the same time, Mr. Chairman, we wish to point out that we are very much in favour of the grant research program of the National Research Council, and here, of course, I am speaking of the peer adjudicated system. This must remain in force; in fact, we feel that it should be strengthened. This does provide for us as well as for our scientific colleagues the opportunity for doing interest-oriented research.

We suggest that in order to put this on a meaningful level the funding should be increased by at least 50 per



cent to put it at the level that existed back in 1970. We are happy to note, by the way, that in the 1976 booklet directed to professors in Canadian universities a new criterion was added for the judgment of research proposals put forth. This is that the research proposal should have as a second criterion that of relevance. We welcome that very much.

Contract research, we suggest, with the university could be a development within the government's contracting out policy. While there have been criticisms of the role played by university professors doing contract research on the one hand by professional groups—and we may hear more of that this afternoon, supposedly related to the non charging for overhead by the university professors, again criticisms have been leveled at the university professors by their own universities, presumably because of the inroads of this contract research on the university commitment of professors—we believe that generally within Canadian universities now, and we have data to substantiate this, policies have been developed to control or eliminate the abuses which have occurred.

We encourage contract research between government and universities on a front-door basis so that monitoring can take place. This development, we suggest, can lead to greater relevance of engineering research, as it should, and we believe that this type of research will lead to the development and solution of specific societal problems, and the better development of our industry in Canada, which, we suggest, is founded on engineering.

We further encourage the funding of unsolicited research proposals, as the Department of Supply and Services is now doing. Thank you very much.

**The Chairman:** Thank you, Dean Kennedy.

We have had two quite different presentations, and that is no criticism, because that is undoubtedly how it should have been done. But due to our rescheduling it raises certain problems for the question period. Perhaps we should start by asking what questions we wish to of SCITEC and of Dr. Forsyth, trying to ration our time, and then if there is not sufficient time left for us to question the Committee of Deans, we could still ask them questions when we have before us the consulting engineers and the Chemical Institute. I can certainly see that there will be room there for dialogue.

**Senator Hicks,** would you begin?

**Senator Hicks:** Mr. Chairman, I am sure you and other members of the committee will not be surprised at the direction I propose to give to the first question I will raise with SCITEC. It arises out of the discussion we had this morning with the Engineering Institute of Canada and the Association of Professional Engineers and their non-membership or non-support of SCITEC, and some remarks which I do not think I would be unfair if I said could be construed as being critical of the posture which SCITEC has adopted, particularly in relation to engineering.

I need not make a long speech, but even in your own statement and in the appendix attached to it more often you mention science and technology leaving out the engineering. Would you like to comment, Dr. Forsyth, in a general way? Then there may be more specific questions on the relationship of the scientists and technologists with the engineers and how serious it is that apparently you have not established much rapport with or elicited much support from the engineering community.

**Dr. Forsyth:** Mr. Chairman, I think historically our relationship was very good at the beginning. Perhaps I could just summarize briefly what it has been. In the formulation of SCITEC the engineering societies played a very real role. In fact, they contributed one of the letters to our name as a necessary part of it.

**The Chairman:** They were "fathers of confederation".

**Dr. Forsyth:** That is right.

**Senator Hicks:** Dans la langue française seulement.

**Dr. Forsyth:** It is certainly true, and I think, by the flavour of the comments we just heard a few minutes ago, that the engineering community's concern that they distinguish between science and engineering is very real. We have to take account of that. We have certainly tried to ensure that the engineering community does take part, and I might point out that a good number of our members are engineers.

**Senator Hicks:** Individual members or members of societies that are members?

**Dr. Forsyth:** Individual members and members of our council and executive. We have had at least one and I think two past presidents of the society who have been engineers. Dr. Wynne-Edwards, for example, is a registered engineer in two provinces. There are many engineers, therefore, who are concerned about just the problems we address in SCITEC. I would like to emphasize that it is not possible for SCITEC to tackle the problems that are better tackled by disciplinary societies, societies which have the expertise that they can apply to a specific problem which lies within their discipline. One thing SCITEC can do is to promote the discussion between disciplines, which we believe to be fruitful. We believe that these are the necessary conditions for the proper application of science, engineering and technology in Canada. So we still have a very strong hope that if we can get this message across to the engineering societies in Canada they will join with us. It is, of course, true that it is difficult to get the large message across to the societies because many of the societies in Canada are very much preoccupied with their problems, and particularly the threats to their own particular discipline. I do not want to imply from that that the engineering societies themselves are not concerned with the larger problems, but I do believe, and I hope eventually to persuade engineering societies of this, that we are attempting to promote discussion between all those who can contribute to the solution of Canada's problems. These include engineers, and many non-scientists, if they choose not to be called scientists. We have some trouble because in some circles engineering is regarded as being a part of science, but we have heard today that there is a feeling that they should be separated.

**The Chairman:** We heard today that some scientists look upon engineers as plumbers.

**Senator Godfrey:** Apparently they did not just look on them as plumbers; they actually said it.

**Dr. Forsyth:** I should emphasize that it is very difficult for me to speak for SCITEC in any of these matters, because, of course, SCITEC is made up of a very diverse group. Anything you would hear from me, or, I presume, any one of the other members of SCITEC who are here to

speaking today, I am sure, would be somewhat influenced by their personal attitudes.

On the subject of the attitude as between science and engineering, I like to point out to my own students that the distinction between applied science and engineering is a relatively recent development in the world of science. One hundred years ago many people who are now regarded as great scientists regarded themselves as engineers. I think this historical change in attitude is something that has come about because of the specialization of science and the growth of individual disciplines. It would be good for us if we could get over it, but unfortunately that is the way science has gone.

**Senator Hicks:** I take it you concede, then, that SCITEC, if it comprises geologists, chemists, physicists and biologists and so on, does not presume to speak for the discipline of biology or the discipline of physics, and so on.

**Dr. Forsyth:** Definitely not.

**Senator Hicks:** Why is it, then, that this seems to be at the root of your difficulties with engineers, who said this morning, in so many words, "We do not think that SCITEC should be speaking for the engineering profession in Canada. Our own organization is capable of doing that better than SCITEC"? It seems to me that there is a misunderstanding here about which my initial reaction, quite strongly, is to say that it ought to be resolved, if possible.

**Dr. Forsyth:** Well, certainly we have been struggling hard over the last few years to solve that particular difficulty. It is clearly a question of communication. Perhaps I could get an engineer to speak to this.

**Dr. H. R. Wynne-Edwards, Vice-President, The Association of the Scientific, Engineering and Technology Community of Canada:** It is perhaps a little unfair, but I think it is true to say that the bulk of the problem lies with them, and not with us.

**Senator Hicks:** They would have said exactly the same thing this morning, using the same words, but meaning other people.

**Dr. Wynne-Edwards:** One of the problems, of course, that SCITEC had to face is that the scientific community—and I use the word "science" with a small "s" in the very large sense—was totally disorganized—it is somewhat more organized now—whereas the engineers, and other professional groups that had a professional licensing and regulating function were well organized, and they were early on the scene and quite naturally were protective of what they had been able to create. They were quite sure that they already had structures in place that were effective in the sphere of communication. The medical fraternity is another good example of this sort of thing. I think many groups who do have a professional label on them, like the geologists, for example, and who also function as scientists, have had a great deal of difficulty in some associations in reconciling the two. The scientific exchange of information, and professional regulation are not necessarily compatible activities, which is why there is a split in the organization of the engineering fraternity.

Similarly, I think the engineers feel comfortable with the organizations they have and are anxious to distinguish themselves from scientists. They do not feel the pressure to join us that we would like to exercise on them.

**Senator Hicks:** I think it is true that probably you need them and their support more than they need yours at the present time.

**The Chairman:** But the Engineering Institute, as we heard this morning, and the professional engineers, were the ones, according to them, to make the last move, a year or a year and a half ago, to SCITEC, and to renegotiate an arrangement, and apparently, according to them, they did not receive any kind of positive response from SCITEC.

**Dr. Wynne-Edwards:** I defer to my president.

**Senator Hicks:** There is certainly a great divergence of opinion and attitude based upon what we are listening to this afternoon and what we heard this morning, and this is bound to be of concern to us.

**The Chairman:** We are trying to reorganize a dialogue here.

**Dr. Forsyth:** Certainly, I have been associated with the SCITEC management for a few years now, and this has been a matter of continuing concern. We have certainly been writing to them regularly saying, as it were, "Can we explore this again?". And our past presidents have met with their presidents regularly in the hope of renegotiating the arrangement from the beginning. There have been some unfortunate incidents in this, as I am sure there are in all human relations. Certainly, we are still anxious for the engineering association to be a part of SCITEC. We have been anxious, too, to assure them that we have no intention of speaking for engineering any more than we would speak for the Canadian Association of Physicists, or any other group; but we do feel that we can promote discussion between physicists and the engineers and the biologists and the engineers and the clinical investigators and the engineers, and so on.

**Senator Hicks:** I would hope so, too. Perhaps we need not develop this any further.

**Senator Godfrey:** Can I ask just one question on that? The engineers' main complaint, I gathered this morning, was that you would not give them sufficient representation on the board. This was because they had only one or two societies, each of which had only one vote, as opposed to the vast, fragmented scientific community, which had so many. They also said they were anxious to discuss problems with scientists provided that SCITEC did not pretend to be the voice of the engineers. You have just said that you were not anxious to do that kind of thing.

**Senator Hicks:** But you have not put that view across to them. In order to put this into perspective, they claim to represent some 80,000 individuals across Canada, and I suppose that is approximately correct. Somewhere in your literature you suggest—and I am not talking about the number of members you have—that your member societies include some 35,000 people. What proportion of eligible membership of scientists that exist in Canada would these represent?

**Dr. Forsyth:** I am sorry. I could not answer that. I do not know whether there is anyone else here who can speak to that.

**Dr. Wynne-Edwards:** It is very high.

**Senator Hicks:** Is it more than half?

**Dr. Forsyth:** Oh yes. I think so.



**Senator Hicks:** I see. So that even if you got every eligible scientist associated with SCITEC in some way or other, you would still be outnumbered two to one by the engineers?

**Dr. Forsyth:** That would depend, of course. Perhaps we should ask Dr. Bergeron to comment on this. There is the very large medical community which stands in somewhat the same relationship to us as do the engineers. There are professional considerations there.

[Translation]

**Dr. Michel Bergeron, 2nd Vice-President, Association of Scientists, Engineers and Technologists of Canada:** With your permission, I will make my comments in French.

There seems to be a mark down. SCITEC cannot speak for all groups. It must be understood that SCITEC is a forum and cannot speak on behalf of doctors or engineers. I can understand the frustration of engineers who feel that SCITEC does not speak on their behalf. Medical people feel the same way. I am one of them and people have said to me: "You are not going to join SCITEC, it's for engineers."—Very strange!

**The Chairman:** There certainly is a communications problem!

**Dr. Bergeron:** Yes, or else, a misunderstanding. Perhaps there is a problem of comprehension somewhere.

To resume, SCITEC is a forum. It is wrong, particularly for the government, its members, and all Canadians, to think that there is "one voice for science". There cannot be one voice for science. There are too many expert opinions, etc. The idea of SCITEC is to make possible an exchange.

One other comment I would like to make . . .

**The Chairman:** Before you go any further—that is exactly what the engineers said to us this morning. They said: "If SCITEC is to be the voice of engineers, we are against it; if it is to be a place where scientists and engineers can exchange ideas, we are for it." That is why I said that perhaps you are having a communications problem, because I believe that basically, you agree. I do not see what the hangup is, since you do agree.

**Dr. Bergeron:** Nor do I, I have no idea. It is obvious to me that SCITEC is a forum.

The second comment I would like to make concerns the problems of communication and terminology. Mr. Kennedy said that on one hand, you have the scientists and on the other, the engineers. Now, I teach medical students. We try to teach them to be scientists. To us, an engineer is a scientist. The doctor who applies a vaccination and the engineer who applies the Bernoulli principle, or any other principal, have the same problem. In other words, I personally disagree with Mr. Kennedy, especially with his comment to the effect that engineers are not scientists. Once again, I am sure that it is a question of terminology, which is unfortunate. To me, science is a whole. We must remember the words of Saint-John Perse who said, while accepting the Nobel Prize, that "poesis" means "creation". Saint-John Perse is a great poet. We are all poets. In fact, we are all creators. In his magnificent speech, Saint-John Perse drew a parallel between poetry and scientific genius. I think that the speech should be read and included in today's proceedings.

[Text]

**Senator Hicks:** That was extremely interesting because the chairman's comments exactly represented the position that was taken by the engineers this morning. They just said that SCITEC was trying to be what the last speaker protested it never could be. So one would hope that perhaps from even this little interchange that a new effort in reconciliation or rapprochement would be made.

**Dr. Forsyth:** I can assure you that each of the presidents of SCITEC has met with each of the presidents of the EIC and where possible with the CCPE, and I firmly intend to do the same myself.

**The Chairman:** I wish we would emphasize this, because as a committee we think that it is very important for this dialogue to be re-established. After all, as you say, we are a small scientific and engineering community here. There are a lot of disadvantages to this, but one advantage of being small is that we should be able to talk to each other. As they often say on French television, "Il faut se parler." I think you ought to proceed with this in a very serious manner.

**Dr. Wynne-Edwards:** May I add one short comment? One of the particular strengths of SCITEC now is the participation of social sciences which is now very strong and active. There is a contrary sensitivity. I remember on one occasion making a rude remark about economists. The economist who was there said "But we are scientists."

**The Chairman:** Of course they are.

**Senator Hicks:** I do not think we had better start into that.

**Dr. Wynne-Edwards:** What this is revealing, of course, is that there are common problems which concern knowledge in general. These are the sorts of thing SCITEC is trying to create a climate for in debate.

**Senator Hicks:** It is clear that SCITEC, as represented by its officers here today, does not think of itself as an agency that is going to speak on behalf of the various disciplines that make up the total of science in Canada. It has been suggested that you should provide a forum—and indeed you have already on some occasions arranged one—wherein the problems of science and different scientific disciplines can be discussed. Beyond that could you in a few words say what you hope SCITEC will become? In other words, do you want to be a lobbying force, not a spokesman for biologists and physicists and economists or engineers but a spokesman for science in general in Canada and an influencer of governments?

**Dr. Forsyth:** As I see it, and I tried to convey this in my opening remarks, we really have to be a vehicle for promoting communication about science in Canada. Along with promoting the communication about science, you also have to promote the communication of science. But that communication has to take place, in the first instance, among the scientific community itself, because this is needed in Canada. If that job had been done, then we would have been moving on already to the second and third stages of communicating with the public. This is a terribly important task in Canada and it has not been done at all well to the moment.

As you know, we have many vehicles for communication in Canada. None of them seem to be successful in terms of informing our own scientific community of the efforts that

are being made in Canada to solve the problems to which science can contribute. Until our own scientific community is informed of these things, it is very difficult to actively communicate with the public. But we must do both. There is no question about that.

If we were successful in generating the necessary discussion of major problems in Canada and informing the public of the need for action in these areas, then I do not think that the third problem, that of being a lobby, would be a difficult one. This would follow by itself.

**Senator Hicks:** By the natural influence that would develop from the well-established organizations.

**Dr. Forsyth:** Right.

**Senator Hicks:** Do you see yourselves as maintaining a registry of Canadian scientific societies and scientists?

**Dr. Forsyth:** We already maintain a register of scientific societies in Canada. That is not just of the members of SCITEC, but all the identifiable scientific societies in Canada. We maintain this and provide it as a service to anyone who wants it and will pay the overhead charges of obtaining it. We keep an up-to-date record of the scientific societies and their officers.

**Senator Cameron:** What is it called and where is it kept?

**Dr. Forsyth:** It is kept in the scientific office. Do we have an official name for that?

**Mr. J. Y. Harcourt, Executive Director, SCITEC:** No. It is just our index to scientific societies. It is updated once a year on a regular basis. Right now it is in the process of updating because we are getting returns now from annual meetings of the various societies. Usually October and November is when it is most up to date. Most of the scientific societies meet in the late spring and summer. And some in early fall.

**Senator Hicks:** That is in your Slater Street office in Ottawa?

**Dr. Forsyth:** That is correct.

**Senator Cameron:** I wonder, Mr. Chairman, if we could have a copy of that?

**The Chairman:** If you pay.

**Senator Cameron:** How much?

**The Chairman:** As a supplementary, is this endeavour a continuation of Dr. West's study?

**Dr. Forsyth:** The beginning of its inventory was the study carried out by Dr. West. We have kept it up to date since that time, changing the names of all the officers of the societies as changes take place. We think it is a valuable resource.

**Senator Hicks:** But you do not keep such an inventory of individual scientists?

**Dr. Forsyth:** No. We do not have a list of individual scientists in Canada.

**Senator Hicks:** If we came to you saying that we want 10 persons to participate in a conference on some aspect of fusion or atomic physics, you would not respond to that?

**Dr. Forsyth:** If it were a question within a single discipline, we would refer you to a society that had it. But if it

were a question that involved several societies, we would go to the societies—we have done so on occasion—to try to organize a suitable response to such a request.

**Senator Hicks:** Some laymen in Canada are just a little concerned—I was going to say confused but perhaps concerned is a better word—at the proliferation of agencies. There is the Science Council of Canada and the various other councils, and now there is the suggestion that the National Research Council and the Canada Council should be further broken down into different bodies. MOSST itself means that we are having quite a proliferation of agencies which somehow or other purport to speak for some aspects of Canadian science. I suppose we are a little concerned that SCITEC merely adds to this conglomeration without clarifying the issue any.

**Dr. Forsyth:** Of course, SCITEC was formed because of what was perceived to be a void in Canada. Other nations have had for many years organizations such as the American Association for the Advancement of Science in the United States, and the British association in Great Britain, where there was already a forum for the discussion of problems to which science could contribute. In Canada there was perceived to be a void, and SCITEC was formed to try and fill this void. I still perceive no other agency that performs this function, and certainly we would be happy to cooperate with any other agency that was similarly minded. We have very limited resources and can only do so much. We would like to be associated with any group that has resources which could further this project. We are firmly committed to the idea that we need this kind of discussion to go on in Canada, and we will promote it by any means we can, either directly or by persuasion of other people if we must.

**Senator Hicks:** Your budget is entirely derived from membership fees at the present time, I take it?

**Dr. Forsyth:** No. At the present time we have a grant from the National Research Council. We have had help from other groups, and industry. In addition, we have the membership fees of the individual societies which belong to the association. We also have the individual membership of those who choose to join the association.

**The Chairman:** You have also had some grants from MOSST.

**Dr. Forsyth:** Yes; from MOSST and the Science Council, among others.

**Senator Lang:** What permanent staff do you employ?

**Dr. Forsyth:** Just Mr. Harcourt and one girl in the office.

**Senator Godfrey:** Approximately what is your yearly budget?

**Mr. Harcourt:** It is \$38,800.

**Senator Hicks:** You have made some tentative approach to establishing liaison or rapport with members of Parliament, at least of the other place, and now you are here before our committee. Do you envisage this as a continuing activity?

**Dr. Forsyth:** Yes, I certainly do. Dr. Wynne-Edwards, who has been closely associated with these efforts, might comment on that.

**Dr. Wynne-Edwards:** We are trying to take two initiatives: One is to request that the House of Commons create



a standing committee on science and technology to which these matters might be referred. The second is that there be a companion committee of scientists and parliamentarians, somewhat modelled on the one in Britain, which has been in operation since 1933. We have made this request of the House of Commons and it is being considered at the moment. We have collected information on the operation of the British counterpart and are discussing it very actively. If this comes into being the hope is that there will be a committee of parliamentarians concerned with these matters, an external body which will seek to exchange information so that one meeting might consist of parliamentarians talking to scientists and the next one the other way around.

**Senator Hicks:** I have had brought to my attention that perhaps you should think of Parliament not just of the House of Commons. Senators are also members of Parliament and we have a continuity which the circumstances of our being here gives us, which is some advantage in relation to the members of the other place.

This committee has, perhaps, taken a more serious interest in the past few years in science in Canada than has any other body in Parliament, and it might not be even too much to claim than any other agency of the government. I was not a member of the committee during the time I refer to, so I am not self-serving in saying this. I might have thought that you would have wanted to establish contact with the whole of the Canadian Parliament, not just with the House of Commons. Their members come and go.

**Dr. Wynne-Edwards:** That is extremely sound advice. The British committee does, in fact, have a large number of peers on it; I believe over 50.

**Mr. Harcourt:** The Canadian committee would be modelled on that very basis, Senator Hicks. The committee would consist of members of both houses.

**Senator Hicks:** Yes, but your submission does not specifically say that.

**The Chairman:** They assumed that we were already prepared here to join with the scientists in their dialogue.

**Mr. Harcourt:** I might say that that structure has gone to Mr. Lambert, and the restructuring committee. It specifically recommends that.

**The Chairman:** Would you envisage two different bodies, one for scientists and one for parliamentarians, rather than one body composed of both elements?

**Dr. Wynne-Edwards:** No, there would be one body of both elements. The hope was that there would be a standing committee of the House of Commons to which these matters might be referred, somewhere to carry the message once it had been defined.

**Senator Hicks:** And my question is whether you should consider that as being a standing committee of both houses rather than just of the House of Commons.

**Dr. Wynne-Edwards:** Absolutely.

**Senator Hicks:** Or, perhaps, somewhat tied in with this committee. We have a number of joint committees which bridge both houses.

**The Chairman:** We would, perhaps, be a little reluctant to have a joint committee on science policy with the House of Commons, because we do not operate in the same way at

all. However, certainly for that type of purpose we could join with the House of Commons to have a joint undertaking with proper representatives of the scientific and engineering community.

**Senator Hicks:** That is the main gist of my questioning, Mr. Chairman. I do not wish to raise any other topics at this time.

**The Chairman:** Are there any other aspects on which we have not touched? Although time is passing, I am sure we would like to spend more time with you.

**Dr. Wynne-Edwards:** Do you wish to discuss the subject of public awareness and communication which is something to which we are devoting a good deal of time?

**The Chairman:** Yes, if you wish to describe your activities in this area.

**Dr. Wynne-Edwards:** Again I am speaking as an individual, because we are not speaking for science and engineering. However, in my opinion it has become clear to many of us that the process over the last few years—which has been interacting with parliamentarians when we could, presenting briefs to cabinet ministers and addressing this committee and others—is accomplishing one thing, but there is a very much larger task to do and that is to raise public interest in science and scientific matters. Political interest will automatically follow. Therefore, we have spent a considerable amount of time wondering how we can create a more effective kind of scientific communication in Canada. One of the things that will have to happen is that SCITEC, as it is presently constituted, will have to slowly evolve into something like an AAAS so that we can invite more individual members and seek to involve people such as teachers, and so on, who are interested in science but not necessarily practising it. This will take some time, but I think we are all determined that this is the way that SCITEC should evolve.

Secondly, we are very much concerned with finding better ways to communicate science, both in the newspapers and on radio and television. So there are some initiatives going ahead there.

We now have a common committee with the Science Council to look at media communication. The committee has not yet met, but it has been established and Dr. Bergeron is very much concerned with that.

[Translation]

**Dr. Bergeron:** I do not have much more to say. In November, SCITEC will hold a mini-forum on the relationship between science and the media. The participants will be, on one hand, Doctor Suzuki, a scientist who has studied this particular problem, and on the other, representatives of various branches of journalism, such as electronic reporting. Mrs. Dotto and Mrs. Denise Bombardier have been invited to speak to scientists about their problems, that is, about our communication problem.

All this simply reinforces what Professor Wynne-Edwards has said. The problem of communication among scientists and with the general public.

**The Chairman:** Do you not feel that in the past few years, the situation has deteriorated? For example, I believe that in 1968-69, when we held our first series of hearings, there did exist an association of scientific journalists which seemed to be quite active.

Since then, I do not know whether it has disappeared completely, but it seems much less active than it was at that time. I think that we shall have to try twice as hard to achieve success.

**Dr. Bergeron:** An excellent beginning, Mr. Senator.

[Text]

**The Chairman:** We wish you good luck with this very important aspect of the problem. We would certainly be happy to try to help as well. My colleagues and I have made a number of speeches, but that is not enough.

**Senator Carter:** Before these witnesses leave, perhaps I could ask whether these projects which they list here on page 2, which they carried out for the Science Council and for MOSST, were public projects or were the property of the Science Council. They have been completed, apparently.

**Dr. Forsyth:** The first one, of course, is a public document. It is a publication of the Science Council Report No. 25. That was Dr. West's study. The second was the property of MOSST. I do not know whether that has ever been made a public document, but it has certainly been widely distributed. Of course, the last one is an effort of our own which is the formation of this House of Science, which we are doing by just incorporating a group, wishing them well and hoping that they can find the money to bring the House of Science into being.

**Senator Carter:** What will this House of Science do in addition to what you are doing now?

**Dr. Forsyth:** It would be primarily to provide the facilities for the scientific societies in Canada to be more efficient in the operation of their own affairs, and there are many very small societies, for example, which cannot afford to operate even a one-man office, but by bringing them together we would hope they would be able to do more than that.

**The Chairman:** Has there been any progress recently on this project?

**Dr. Forsyth:** The interim board of HOSTE Corporation has met just in the last week. I am afraid I was not present, but a certain number of societies have already indicated their intention to be part of the Hoste project. As I hope it is clear, we are not setting this up to be run by SCITEC, but because we feel it is a good thing for science in Canada. It will be a separate corporation.

**The Chairman:** It would be a kind of scientific commune?

**Dr. Forsyth:** Yes.

**Senator Lang:** Would this involve a physical presence?

**Dr. Forsyth:** Yes. We would hope that there will be quarters here in Ottawa and that it would be run on a kind of rental basis. There is some hope that there would be industrial support for such a concept and it would provide a place for bringing together various societies and, of course, sharing facilities, and also promoting the kinds of discussion necessary between societies.

**The Chairman:** Thank you very much indeed. I am sorry we have no more time, but we certainly hope you will be successful in your dialogue with the engineers; we will

be hearing a very important element of that community now.

We will now hear from the Chemical Institute of Canada.

Mr. Morrison, would you please make an opening statement and introduce your delegation.

**Mr. J. A. Morrison, President, Chemical Institute of Canada:** Thank you, Mr. Chairman. Perhaps I can point out first Dr. H. G. McAdie, Chairman of the Board of Directors of the Chemical Institute of Canada, who is at the Ontario Research Foundation. Next to him is Mr. T. H. G. Michael, who is the General Manager of the Chemical Institute of Canada and who is with the head office of the institute here in Ottawa. I should also like to point out Mr. Don Emerson, who is the editor of *Chemistry in Canada*, a society publication.

I might say for myself that I am professor of chemistry at McMaster University. I also fiddle around with something called "materials research," which is a multi-disciplinary area.

Perhaps to begin I should say that the Chemical Institute of Canada contains a different element: science under the word "chemistry." It also has a constituent society of chemical engineering and a constituent society for chemical and biochemical technology. Therefore, it embraces the science, the engineering and the technology and we try in depositions which we make and in submissions which we make to include these three together in one breath, as it were, because they are all important elements of the society.

Now, the Chemical Institute has made submissions to your committee before.

**The Chairman:** Yes. As a matter of fact, we have received two briefs from the Chemical Institute and I would propose that they be printed as appendices to today's proceedings.

**Hon. Senators:** Agreed.

(For text of briefs see Appendices, pp. 52-65.)

**Mr. Morrison:** Thank you, Mr. Chairman. Perhaps I could make a few remarks about the deposition. As Dr. Forsyth was mentioning, it is difficult in a position like this to speak for the society without putting in your own biases. I am afraid that this is what will happen here. My biases will show to some extent.

The first point I should like to make is that the latest brief submitted to you is one concerned with the funding of scientific research and development. It contains some general statements, but also some specific information in the form of statistics in tables at the back.

I am sure you will be familiar with the statistical information, but the statements that accompany this information are necessarily compromises of the views of a large number of members. As I have just emphasized, we have engineers, chemists and technologists. So I think you cannot expect to have a unified voice coming from a society of this nature, but I hope you will accept reasoned and logical views that are put forward for your consideration. In spite of these reservations that I am entering right at the beginning, I would like to set out three general points with which there would be, I believe, rather little disagreement.



The first point is that the Canadian investment in science, engineering and technology has not, on the whole, been managed very well. This is, perhaps, shall I say, an understatement.

The second point is that we believe that a momentum of logical development in science, engineering and technology, which was occurring and was going on until the early 1960s has now been lost.

The third point is that the vigour, intelligence and training of excellent young people in science, engineering and technology is not being used to the best advantage by a rather wide margin.

Those are general points, and the deposition that we have made contains facts and figures about the funding of scientific research and development; but the trouble with statistical information is that you can always twist it around to prove the case that you want to make, and just in passing I would like to refer to a point that Dean Kennedy made. He said that only 2 per cent of the developments seen through project Hindsight came from rather basic studies. On the other hand, if you look at a publication of the Canadian Science Board in the United States, you will see that references in the patent literature are very heavily biased towards basic studies. This is a different way of looking at the same thing, and so you pick what you want. This is, I guess, the moral of it. On the other hand, there are some facts that are inescapable, and these are the facts that I would like to set out for you now.

We talk about how funding for research and development has been cut back over the last few years, but what does this mean? Let me break it down to particular cases.

Something like four years ago a highly recommended young inorganic chemist was appointed to the Department of Chemistry at McMaster University. To begin his research he got what is called a starter grant from NRC, and this was \$4,500. The Department of Chemistry at the university found another \$4,000 for him, which made \$8,500 with which to start his research. Out of that he had to pay part of the stipend of one average graduate student, whose services he also got. He also had to pay for any use he made of the general facilities within the department or the university.

It just happens that I know of a comparable young inorganic chemist who was appointed to the Massachusetts Institute of Technology at the same time. I think that you would have found it very difficult to distinguish between these two young men at the time.

The young man at MIT received a grant of \$28,000 to start his research. He was given six first-class graduate students, and had free access to all the large experimental facilities at MIT. I do not think there is any university in Canada that could have matched that kind of backing for a young man, and I do not think that McMaster is unique; but this is what these numbers mean, when you come down to the question of investment in science and technology.

What we are saying to our young people, in effect, is, "O.K. You can do research in Canada if that is the thing that you really want to do, but we insist on tying one of your hands behind your back before you start." This is what it comes down to, and so I invite you to interpret these figures in this way when you see the table indicating that Canada is spending only such and such an amount, or a fraction of the GNP on research and development.

There is one other thing that the numbers in the tables of the Chemical Institute of Canada's submission obscured. If we look at the various rankings of the various countries we see expenditures on basic research, cross-expenditures on research and development. What this obscures is what you know if you are actively involved in science and research these days, namely, that that is where the real action is, in Germany. This is the place where the young people are getting the opportunities, in universities, in industry and in government developments. What is happening in Canada is that we are simply not providing these opportunities to the young people. We talk about shifting the onus of supportive research more towards the applied and developmental spectrum, but this is not followed through by providing opportunities to these young people. Industry at the present time is simply not very attractive to the best young people who are coming out of the Canadian universities. The upshot is that those who are very good, and those with a compelling interest in applied research, tend to migrate to the Bell labs and the central Dupont labs in the United States. This is something that we have been faced with for a long time.

**The Chairman:** This is the case in industry too.

**Mr. Morrison:** Yes. On the other hand, somehow they seem to have raised the level of our activity to a point where it is very challenging to these good young people who are around.

The final point I would like to make in presenting this brief is to express some disappointment at our collective inability to capitalize on the high quality developments that do occur in Canada. In the area of chemistry I would just like to select one example, though others could be selected, and this is the sub-field of organic chemistry. This happens to be a field where there has been a rather nice logical development over the last 20 years or so, where two or three very good organic chemists in the country stimulated young people, who then went on, and in turn stimulated other young people. So organic chemistry is an area that has come along quite nicely.

On top of that this is the important point, some of the really top-notch organic chemists in the country share a conviction that one ought to see some follow-through from basic things, and I will name two or three of these. One is Professor Raymond Lemieux, with whom you may have talked, at the University of Alberta. He has had this conviction terribly strongly and has started two chemical companies, one of which has been taken over by the Canadian Development Corporation, now Raylo Chemicals. But he has another one.

There is also a group at the University of Western Ontario that perhaps Mr. Forsyth could speak to in greater depth, there is a group in photo chemistry behind Professor Paul de Mayo and this group is trying very hard to push out from basic studies in photo chemistry to applications to photo chemistry in chemistry, biology, and any other place it will go.

A third person I should mention is Professor Bernard Belleau, at McGill, who, for a number of years, has been a co-director of research for Bristol-Myers. He is supported by an American firm. He has very strong convictions about the consequences of organic chemistry as applied in medicine and pharmacology. These gentlemen and others like them have suffered terrible frustrations in trying to get the kind of support that they need and I would like to submit that this is where we want to look for the future.

We do not want to compete with the Xerox Company in developing new methods for reproduction, or IBM, or new techniques of computing. What we want to do is find these extremely good, younger, highly developed people in the country and particularly those who have a conviction about seeing science applied to our general benefit. We have not somehow devised the mechanism to pick these people out and get behind them.

I will stop there, with your permission, Mr. Chairman.

**The Chairman:** Thank you very much. I am sure we will want to come back to some of the points you have raised.

We will now hear from the president of the Association of Consulting Engineers of Canada, Mr. Beauchemin.

**Mr. P. T. Beauchemin, President, Association of Consulting Engineers of Canada:** Mr. Chairman, our association is a business organization whose main objective is safeguarding and promoting our interest...

**The Chairman:** We are going too quickly. May I have a motion that the brief of the Association of Consulting Engineers of Canada be printed as an appendix to these proceedings?

**Senator Hicks:** I so move.

**Hon. Senators:** Agreed.

(For text of brief see Appendix, pp. 66-93.)

**Mr. Beauchemin:** The R&D committee, chaired by Mr. David Newman, prepared this brief. Mr. Newman is with me today. The incoming chairman, Mr. Ian McCaig, is also present. With us is our managing director, Mr. Harry Pinault, and Mr. Eon Fraser, our director of research and communications.

Mr. Chairman, I feel that Mr. David Newman, who is responsible for the assembly of this brief, would be in a better position to make comments.

**Mr. D. Newman, Past Chairman, R&D Committee, Association of Consulting Engineers of Canada:** Mr. Chairman, we are a group of businessmen—that is the best way of describing it—with a difference. We are consulting engineers in private practice.

The Association of Consulting Engineers of Canada, the ACEC, represents 785 firms across the country, with a total employment of 28,000.

**Senator Hicks:** Not 28,000 engineers.

**Mr. Newman:** We probably represent less than 10 per cent of the total number of engineers in Canada.

**Senator Cameron:** Are any of them connected with the universities at the present time, on part or full time?

**Mr. Beauchemin:** One of our members here is. We do have some members who teach at universities.

**Mr. Newman:** We have many members active in teaching.

**Senator Cameron:** What percentage, roughly?

**Mr. Ian McCaig, Chairman, R&D Committee, Association of Consulting Engineers of Canada:** Very small.

**Mr. Newman:** Let us just say in each firm we can point to several of our senior people who are active in universi-

ties, trying to extend their own know-how in the community.

As consulting engineers, there are really two attributes and one attitude. We are based on technological and managerial capabilities—these are the two foundations—and an entrepreneurial attitude. In this day and age, “entrepreneurial”, to us is not a dirty word.

**Senator Godfrey:** “Promoter” is a dirty word.

**Mr. Newman:** “Promoter” is not a bad word either because we are promoters of business, particularly on behalf of Canada and the export markets, and we are also promoters of know-how. I use that word “know-how” a fair amount.

We are very competitive among ourselves. ACEC does try and represent the issues we see in common. When it comes to the business environment we are fiercely competitive. Engineering is our main thrust, but we have many other kinds of skills in our firms because as clients have become more sophisticated and as the breadth of projects has extended, we had to bring these in. The environmental dimension is a good example. We have ecologists, environmentalists of all kinds, sociologists, economists, mathematicians, physicists, chemists, psychologists, sociologists—you name it. You will find our firms are quite broad in our scope.

We are Canadian in fact. This is unusual in the private sector in Canada. You can look at Canada as a series of private sectors, as well as universities, government and other agencies. I think the consulting engineering society is Canadian. As I said, we are entrepreneurial. We believe we have to be profitable in order to survive and grow, to do the things we want to do and find exciting. If we cannot do that we will not be able to attract or keep people. People join our firms and stay with us because we can offer them challenges. If challenges disappear, we lose people. I think we say in our brief the whole service business is peculiar that way, perhaps the consulting business more than most. Your assets walk out the door in the evening, and you hope they come back the following morning. You have no guarantee.

As consulting engineers, we are active in what you would call applied technology. We have a bridging role. Science policy generally stems from the ways which science assists the fundamental aims of society. There has to be a bridging between science and society and between different sectors of interest in society. You have heard from a number of interests. We are talking about broadly technological transfer. One of the things we do is bridge between what is happening in the world of science, and trying to apply it on behalf of clients. That's where it's at.

We are also involved in what you could call technological discontinuities. Traditional engineering goes back to the industrial revolution. It peaked in the Victorian era. We are now seeing an extension of technology that has been around for perhaps 200 or 300 years. New technologies are now coming in. If you read *Future Shock* you know that the advent of a new technology can be very traumatic to society. Therefore, as consulting engineers, we feel we have a particular bridging role between the old and new technologies, so that you do conventional things in unconventional ways and move the new technology in gradually at a pace the clients and society can stand.

I mentioned know-how earlier. One of our main points is control of know-how. We believe the control of our destiny



as Canadians is based on the control of our own resources. Know-how is the paramount resource. The trade deficit in management and technical services in Canada is \$1 billion a year. That means we are importing \$1 billion a year more of management and technological know-how than we are exporting.

The Honourable C. M. Drury gave this definition of what the goals of science policy might be:

Concern for the creation of an environment conducive to the development of an indigenous technological capability in Canada which will contribute to the country's social and economic goals.

We are very strong in this indigenous technological capability. One of the paramount capabilities, again looking at both managerial and technological—you need both—is project management. Project management means having the skills and systems to plan and manage the development of our own country. It is peculiar to look at Canada in this day and age, we say we are a sophisticated country and we are independent. Yet as you look at the major important projects in Canada, the ones that are landmarks, of applied technology, you will find more often than not, that management of these particular projects is given over to foreigners. This is done by government and major industries in Canada. Some of these firms claim they are Canadian because they have Canadian employees, but the know-how and the reputation goes to a foreign firm. We then have to compete with them abroad. They are using the projects they have managed in Canada in their repertoire of experience against us.

As a blanket statement, we believe there is no project in Canada, no matter how large of how complicated, that cannot be managed by Canadians.

On national science policy and programs, we would like to see much more private sector involvement. We find that the research and development projects—the other projects related to science that are handed out to the private sector, in what we would describe as bits and pieces—are piecemeal. The projects are then handed out, and even then they are not handed out for implementation as a whole. In general, there are a few exceptions.

We feel that there will be a better involvement of the private sector, a better technological transfer and a smoother political environment in this country, if there is more involvement of the private sector at the planning and conceptual phase. Another example of that would be the environmental area. There the consulting engineers have been active and their role has been recognized. We have advised government, we have worked with other parties, discussed and arbitrated, and, as a result, we believe we have avoided much of the confrontation that has taken place in the United States and elsewhere. We believe this could happen on other occasions as well.

The conceptual phase is where there is real potential for innovation in the economy. We would like to play a role there. We would like to be involved so that policies and programs are practical as well as effective and human. In brief, then, government strategy should be a process of national policy creation and implementation, based on extensive consultation and contracting out at all stages.

On "make or buy", as a policy, we are happy with it. We are very happy with the report that MOSST wrote and we are happy the policy has now been extended for later scientific activities in the human sciences. We are not happy with everything DSS does. We have a good dialogue

with them. We can talk to them. We have not convinced them yet; they have not convinced us. We would like to see "make or buy" broadened so it would gradually cover all government scientific activities, existing as well as new projects.

On know-how, we need access to skilled and experienced people. By experience we mean current experience. If we are talking industrial technological transfer of the development of a science policy that has a positive payoff in industrial expansion in Canada, then you need hands-on experience in industry. We need closer relations with industry. Industry offers facilities for applied R & D because that is where it is happening. When they get involved in a process they get the practical experience.

It is to industry that we look for people who can operate and manage plants and maintain them. This is where we would have to bring people from overseas to get trained to build, operate and maintain the plants that we put in for them overseas. The attitudes of Canadian industry are not entirely friendly towards us, so again it is not a case of a dialogue between the deaf. We are trying to come to grips with how to get a better working relationship with them. We do this with some of our firms piecemeal, on an individual basis and it is beginning to work. However, if Canada is to play a role and it must, because our economy is sophisticated and we need that world market, if we are going to challenge it and attack it successfully there must be a very close rapport between ourselves, industry and many other sectors, including government. We have good relationships with the Department of Industry, Trade and Commerce.

By the way, as consulting engineers we have taken a leading role in developing world markets.

We do packaging, which is bringing together the financing, technology and managerial skills and putting them together for the client. We do design and protect management abroad. Have you seen the book, recently published, *Ideas in Exile*, about Canadian inventors who had to live abroad in order to get their inventions taken up? We feel we have greater recognition abroad than in Canada. We hope that recognition will also come in Canada.

The combination of things that Canada has to offer the world are know-how, capital investment and innovation. Capital investment is also a necessity for us in Canada and we have to look very hard at what is happening today, because if our clients are unable to invest, then this whole basis of applied technology and current experience goes down the drain. If, for example, nothing modern in the metallurgical field is built in Canada for the next few years, current experience will be elsewhere, which is dangerous for Canada. Right now we are seeing a lag in capital investment in this country which we feel is very serious for the whole of science policy. This kind of thing can set us behind for years.

I do not know whether the final point will be popular here today, but it is something we believe in. It is that the trend to bigger government must be reversed. There is a fundamental statement in that; we believe that government should contract for work and not for people. This applies to science policy and we believe it applies to many other areas also. We feel that the most dangerous challenge to freedom comes from elite, centralized power, because there is too much government and too big government in Canada. We do not believe it is inevitable. People have been saying for several years now that it is inevitable and we just have to learn to live with it. We are doing our best

to live with government, to take advantage of it and to work with government; this is to the good.

However, at the same time we want to challenge this attitude that government must get larger and larger and the rest of us must be passive. We believe, although we do not know quite how to do it, that there should be pluralism and each person in each organization is responsible in themselves. It is not the exclusive prerogative of government or anyone else. This, again, takes a change in attitude in the private sector, as well as a change in attitude in government.

Those are the main points. They are all summarized in our brief, which I have tried to highlight for you.

**The Chairman:** We have approximately an hour and a quarter in which to pose questions.

**Senator Godfrey:** I would like to address one question to Mr. Morrison. I could not help but think when you were using MIT, which I understand is the Rolls Royce along with Cal Tech., whether we might not have the same complaint we were hearing from someone in the engineering school at the University of Buffalo.

**Mr. Morrison:** I think we have to aspire, and our quality and standards in science, engineering and technology are terribly important and we must aim high.

**Senator Hicks:** The point is that there are several institutions in the United States that could do what Professor Morrison says was done for the young man at MIT; there are none in Canada.

**The Chairman:** Do not forget that Harvard is still at a higher level.

**Senator Godfrey:** My comment, though, was that it is not completely comparable. If you had compared yourselves with the University of Buffalo, you might have been a little more modest and relevant, shall we say.

**Mr. Morrison:** We must aim higher.

**Senator Hicks:** Do not be offensive to our witnesses, Senator Godfrey; you cannot compare McMaster with the University of Buffalo.

**Senator Godfrey:** I would like to address a question to the consulting engineers. I found your brief very, very refreshing and enjoyed reading it. You have even criticized the private sector, which is rather unusual. You say on page 2:

The private sectors of society have not provided moral, economic, or technological leadership adequate to our times. Government has inexorably occupied this vacuum.

At the end of your remarks you said you were against government becoming too much involved, which I can understand. However, if the private sector has left a vacuum it is really understandable that government does move in.

**Mr. Newman:** Yes, sir; I think the private sector has gone too far the other way and has now invited government in and is taking not only a passive but a negative attitude.

**Senator Godfrey:** At page 5 you refer to Canada's current trade deficit in management and technological services as being around \$1 billion a year. In that, of course,

you are referring to the private sector, that we import know-how and so on.

**Mr. Newman:** Private as well as government, licensing fees, blueprints and what have you.

**Senator Godfrey:** The government itself has been trying to do something about it in any way in which it can control it, have they not? I am thinking of someone I know in the aerial survey field; they favour Canadian control, do they not?

**Mr. Beauchemin:** I think you have the wrong example; they are not part of our organization, but we have heard recently that the government has equipped itself to do most of its aerial surveying itself.

**Senator Hicks:** And we are doing it for other countries, also.

**Mr. Beauchemin:** There is an association of photogrammetrists and I believe they should defend their own case; they are not part of our case.

**Senator Godfrey:** I knew of that particular case, and I think quite often in foreign aid we tie in with CIDA that they must use Canadian consulting engineers.

**Mr. Beauchemin:** I believe there are four or five definitions of "Canadian" going around in government circles. The various agencies have their own definition of "Canadian". In their view, if it is a Canadian-registered company, it is Canadian, and at the other extreme it must be entirely owned by Canadians. That definition is not too wide spread though; mostly the other definition is used.

Concerning the effort that the government is making to use the Canadian knowledge, I think we have to be and we are knowledgeable of the fact, and we do appreciate the fact, that Mr. Buchanan expressed Canadian policy for the development of petro chemicals or hydrocarbons on government lands. But by the same token an entirely crown-owned corporation named Eldorado Nuclear, at the same time was giving quite a major contract to an American-owned consulting firm for the development or the enrichment of uranium.

**Senator Godfrey:** In an area in which the know-how was in Canada.

**Mr. Beauchemin:** The know-how was nowhere. It is a new process.

**Mr. Newman:** Certainly the know-how was in Canada. This is a landmark project. Again the definition of Canadian comes in. Eldorado will say that this is an American firm. Sure, with a Canadian subsidiary completely staffed with Canadians. When my firm goes abroad and wants to sell a uranium enrichment process the firm we are going to be up against is the one that is doing it for Eldorado now, and it will be the head office of that firm.

**The Chairman:** How can you cope with this in terms of procurement or Canadian government policy? Should you say, "If this is the subsidiary of an American firm, we will not give you any contract"?

**Mr. Beauchemin:** We had the same problem when we got to darkest Africa and we were told to hire sometimes as a prime consultant the local firm, either in Nigeria or some other place, and we were only there to transfer our technology to those people. It seems that it is only in Canada that we are not worried about the transfer of technology to



Canadian engineers. It can be done quite easily. We do not think that we want laws. We do not want to close doors because doors will be closed to us in foreign countries, but at least the crown corporations which are entirely Canadian-owned should be encouraging Canadian consulting engineers.

**Mr. Newman:** I agree with that. We would not want a law which would say that you must absolutely use a Canadian firm. It is a question of attitude. The attitude is pervasive. It is not just at the federal government level. You find it in a lot of Canadian businesses and in provincial governments. They do not believe in Canadians. It is as simple as that.

**Senator Godfrey:** There are some Canadian businesses which are controlled from the United States, but my impression is that with respect to the Arctic gas situation, the government was trying to lean on them to encourage that consortium to use Canadian consulting engineering. They were running into some resistance, though. I recall that some company came into Canada and made itself available because it felt it had a better chance.

**Mr. Beauchemin:** I believe the trend is now reversed in terms of Canada land, that with respect to the crown corporation I do not think that problem is solved.

**Mr. Newman:** The private sector will go along with the government and it will certainly hand out bits and pieces of major projects. I do not think they would hand out, for example, a very large scale petro chemical refinery at this point to a Canadian firm. Imperial, Shell, and these other companies will deal through their head offices and they will deal with large international firms that they are used to. That will be a tough one to crack, but there will be at least bits and pieces coming our way.

**Senator Godfrey:** If you are expanding like Mr. Shaheen with hundreds of millions of dollars, even if it is other people's money, and you use somebody you think is very good even from outside and then you get only 75 per cent efficiency as in *Come By Chance*, then I can imagine the nervousness of Canadian industry preferring people who claim that because of their previous experience and so on who are more qualified to do the work.

I entirely sympathize with your position. The only time I ever wrote to a cabinet minister trying to correct something was to say that he should give preference to Canadian consulting engineering firms, because that is the way to give them the know-how to use abroad.

**Mr. Newman:** It is not even a question of preference, doing us a favour. We would simply like to have equal treatment on merit.

**Senator Hicks:** Notwithstanding what you say Senator Godfrey, there are examples where we deliberately have gone to the United States when competence has existed in Canada. The Government of Nova Scotia, for example, paid hundreds of thousands of dollars to the Arthur D. Little Company for the kind of efficiency studies which were mostly nonsense, and could have been duplicated in Canada just as well and with less nonsense.

**Senator Godfrey:** I thought you were going to mention heavy water.

**Senator Hicks:** The Government of Nova Scotia, when it came to its heavy water plants did not even consult the

engineers at the Nova Scotia Technical College or at Dalhousie University. Apparently they proceeded without knowing that salt water corrodes pipes.

**The Chairman:** No politics, please.

**Mr. Newman:** The rehabilitation of that plant after the damage done was in Canadian hands, so the thing is beginning to work now.

**Senator Lang:** Could the witnesses give us any idea of the extent or percentage of their total volume of business done abroad. What is your export components compared to your domestic.

**Mr. Beauchemin:** We are estimating that this year it will be 20 per cent, \$200 million of our volume, and it is going up. About three or four years ago it was \$40 million.

**Senator Hicks:** In other words, you are doing one fifth of your work outside Canada.

**Mr. Beauchemin:** Yes.

**The Chairman:** How much would be funded by the Canadian Government?

**Mr. Beauchemin:** I do not know.

**Mr. H. R. Pinault, Managing Director, Association of Consulting Engineers of Canada:** Mr. Chairman, I think it is about one third CIDA-EDC and one third international landing agencies, world bank, Africa Development Bank, Asia Development Bank, and probably right now about one third strictly commercial business. That is it roughly.

**Senator Hicks:** But only about one third of the total is really hard money that would not otherwise come to Canada.

**Mr. Pinault:** World Bank's money is hard money.

**The Chairman:** These are international institutions.

**Senator Hicks:** All right, two thirds.

**Mr. Newman:** We assume a multiplier effect on the average of about eight to one for Canadian equipment and other services that follow on our contracts. So that \$200 million should translate into about \$1.5 billion in exports.

**Senator Lang:** You mentioned a trend. I am afraid I did not catch it before—a trend as to percentage of your business exported.

**Mr. Beauchemin:** It is going up tremendously. I do not know the steepness of this curve. I know that in 1968-69 the volume was \$40 million, and in 1974 it was \$100 million, and in 1975 it is \$200 million. We are not going to extrapolate that line.

**Mr. Newman:** This year will be substantially higher because we have to put a lot of emphasis on the export market because the domestic market is depressed. So in order to hold our own the percentage has swung over.

**Senator Lang:** This morning the Institute of Engineers said that they were rapidly becoming non-competitive in the foreign market on engineering services.

**Mr. Beauchemin:** That is right.

**Senator Lang:** This does not seem to jibe with your remarks.

**Mr. Beauchemin:** We did not say we are not worried. We are worried. We say we are becoming. This is why the association gave its cautious approval to the Anti-inflation Board when it was created, because we could see that the scale of the salaries of engineers were going to a level where they were ahead of other countries, and there are other countries where the salaries are lower than ours. There are also some countries where they get greater help from their governments on foreign projects, such as financing help.

**Senator Carter:** Are there any figures of the total market in Canada; what it is worth for your services?

**Mr. Beauchemin:** Or volume of our people, not our membership, but of the consulting engineers, through a Statistics Canada Report—this was a preliminary report only, the official printed document being due in October, and, incidentally, was initiated by the Department of Industry, Trade and Commerce at our request, has identified the total market for consulting engineers in Canada as a billion dollars annually. That was for 1974.

**Senator Carter:** Could you say that we are importing \$1 billion worth so that it must be more than \$1 billion if you are importing that much.

**Mr. Beauchemin:** I am sorry. I could only give you the total of the report of the amount by Statistics Canada. The second phase will be to do an economic study of this to find out where it is going and where it is being spent.

You must remember that Statistics Canada surveyed every Canadian engineering firm in Canada. Be they Canadian or American, as long as they were established in Canada they had to report. I do not know if they picked up every one of them, but they would include some of the revenue by firms not Canadian but operating through Canadian offices.

**Senators Hicks:** Obviously, what concerns Senators Carter is the statement on page 5 of your brief, "Canada's current trade deficit in management and technological services is around \$1 billion a year." If our trade deficit is that, the total market in Canada must be more unless you are including in management and technological services things other than consulting engineering services.

**Mr. Beauchemin:** Yes. It is broader, plus the fact that some of the firms which are American-owned are also contractors and because of a certain selection at Statistics Canada they were in other surveys so they did not have to report to this survey. They were in the contractor's survey, so we lost that amount, which is probably the biggest.

**Senator Godfrey:** But surely, on that subject, there are companies like the electronics companies, from whom we are going to be hearing. A company like Zenith, in the United States, probably has over \$20 million worth of engineering expenditures a year. How can any Canadian company compete with that? Why would they not import their engineering, and drawings, and so on, rather than try to duplicate them in Canada? There is one, Electrohome, that is trying to do its own engineering, but it is not doing very well right now.

**Mr. Beauchemin:** We do not want—and this is something we said before—to close the door against any firm that wants to do business in Canada, but when we go abroad we like to be able to say that in certain fields we are hired by our government and our people, which is not

the case in every field. I come from Montreal, a very sensitive place for the importation of Olympic stadiums these days, and metro systems and James Bay.

**Senator Godfrey:** You did Mirabel, though.

**Senator Bell:** Yes, but are you glad you did?

**Mr. Beauchemin:** Well, I can tell you that we were invited—and I do not know at what stage negotiations are now—by the Russians to tender for the airport that they are building for 1980 in Moscow. We are one of the three competing firms concerned with that, because we did Mirabel. They saw Mirabel in operation, they liked it, and they were in there negotiating. We probably will not get it, because we are competing against a firm that is getting big financial backing from its own country.

**Senator Bell:** This is something that I would like to pursue, if I may. It fits right in there. On a major contract, the company that is going into the job and promoting it has to raise the money somewhere, so it has to be with the banks or the shareholders or whatever, and if part of the selling of this particular project that they want the money for is that they have got Bechtel or some very large internationally well known firm, that perhaps cannot do the job any better, or even as well, if it is a particular, indigenous type of project that Canada is good at, this name goes on the letterhead or the promotional material because this is going to be a selling point to give the shareholders confidence or make the banks shout "Hurrah, this must be sound." How do you get around that sort of thing in developing your own consultant services?

**Mr. Newman:** You are absolutely right. It is a beautiful comment. My own firm has recognized this. Quite possibly, for example, the fact that Bechtel is involved with James Bay, and is managing it, in fact, certainly has something to do with their credibility with the New York financiers. So what we have to do, slowly and painfully, is to get ourselves known to these people.

**Senator Bell:** And yet you may have experts who are more familiar with the proposition than any other country in the world, because it is a uniquely Canadian problem.

**Mr. Newman:** That is true, but at the same time we have to recognize the financial problem as a reality, and so we simply have to get known to these people.

**Senator Godfrey:** They have to be promoters and entrepreneurs too. They promoted the Trans-Mountain Pipeline. They conceived the idea, and sold it, all in Canada. We could have done it, but we didn't.

**Mr. Newman:** We are doing that abroad. If you look at consulting engineering you see that it has changed. If you look at us across the board the traditional pattern of cost-plus does not apply when you come to the international market. We form consortia, we put together general industrial financing, we have corporate financing, and we put together packages. We do exactly what you are saying. We are promoting some very major projects.

**The Chairman:** I am going to ask what is perhaps an unfair question, but how is the training of our own students in engineering in our own universities comparing with other training facilities in other countries? Perhaps Dean Kennedy will want to comment on that one.

**Senator Hicks:** Let us hear the comments of the profession out in the field first.



**Dean Kennedy:** Yes, you are all probably graduates.

**Mr. Newman:** I started under Dean Farnell, so I cannot make too many comments.

**The Chairman:** You are a graduate now, so you can criticize him.

**Mr. Newman:** The only reason I cannot criticize too loudly, is that, as I said earlier, a number of our people are now teaching on the boards of various universities. I think the engineers that are coming out today are maybe better than we are.

**Senator Hicks:** I would hope so. They have to be.

**The Chairman:** How do the facilities compare with the facilities offered in other countries?

**Mr. Beauchemin:** They must be as good, because people want to buy Canadian technology. This is why the doors are so wide open to us in the foreign field.

**Dean Kennedy:** I do not think our Canadian engineering graduates have to take a back seat to anyone. I am familiar with the young men who are coming out who have gone down to do graduate work in the American universities—more in the past than in the present, because we have developed our graduate schools in Canada to a greater extent lately—but young men going out of Ontario, and the western and eastern universities, with B's in our engineering programs, are swamping them down there.

**Senator Hicks:** My first question to Dean Kennedy, had we proceeded in the way I intended, would make a very good supplementary question now. Your brief, Dean Kennedy, largely concerns itself with research and support for research.

**Dean Kennedy:** That is correct.

**Senator Hicks:** Would you comment on the role that research plays in ordinary engineering education in Canada? I ask that because I gathered, from your brief, that you thought research was far more important in engineering education than I think it is.

**Dean Kennedy:** I think there are two, possibly three, parts to engineering education. Maybe there are more, but certainly there is the scientific background, and on that point I come back to what I said earlier, to the effect that science is a part of engineering, but not all of it.

**Senator Hicks:** There are engineers without science, but I do not know if the reverse applies.

**Dean Kennedy:** Yes. We are very cognizant of the need to relate to societal problems, and a major proportion of our engineering education today is oriented in that direction. What is the input of our engineering honour societies? This is extremely important.

The third aspect, which is one that the consulting engineers consider to be very important, is that of developing a sense of professionalism in the engineering student, and we are trying to play a greater role in that field.

The fourth aspect, of course, is that engineering education, even at the undergraduate level, has to reflect the up-to-date research that is being done, so that our students are aware of the latest engineering developments. These are all parts of the package.

**Senator Hicks:** Even when only graduating with the first degree, the bachelor's degree in engineering?

**Dean Kennedy:** If I may take, for example, what Dr. Farnell and Dr. Callaghan were discussing this morning, I look back at my own engineering education, which was finished at the bachelor's level 25 years ago—we had a great reunion back in June—and in dealing with the design of steel structures we had simply to deal with one specific type of steel in designing them. Today, in Canada, when we design steel structures, we may deal with ten or fifteen types of steels, and each one of those has a different application which enables you to use it better than in another. That means that our young engineers are developing today much better than they were back when I was an undergraduate student. We have to keep up. Part of keeping up—and this is our concern, Mr. Chairman—is that at the undergraduate level the students get the up-to-date knowledge, which relates to research. We say that it is a vertical integration between the undergraduate student, the graduate student and the research.

**Senator Hicks:** Just one step further along the same line, then. Is it possible to compare the role of research in the average engineering school in Canada with forms of engineering education in other countries? I realize that engineering is often taught in quite different ways in other countries of the world.

**Dean Kennedy:** May I have that again?

**Senator Hicks:** Does research play a more important role in our engineering schools in Canada than it does in those of other countries, or substantially less, or what?

**Dean Kennedy:** I think it plays an equal role. When I look to the United States, I compare us to the good schools in that country. I do not compare us to the others.

**Senator Godfrey:** You do not compare yourself to the University of Buffalo.

**Senator Lang:** May I refer for a moment to the consulting engineers? With regard to this tendency to eschew Canadian consultants, as opposed to their competition from abroad, do you find that this tendency is exhibited in any way by DSS, in its "make and buy" policies?

**Mr. Newman:** No, sir.

**The Chairman:** Your main worry is with crown corporations.

**Mr. Newman:** Crown corporations and, I would say, at the policy level, wherever that is, in government. I am not just speaking of the federal government.

**The Chairman:** Well, it seems to me that you referred at some stage in your brief to the ministers—and I do not want to defend the ministers at the federal level—who were more sympathetic to your representations, and you quoted, I think, the Honourable Mr. Buchanan, with specific reference to his attempt to do something in the north. So the impression I got was that your main worry was with crown corporations.

**Mr. Newman:** Across the board, you can say we are winning gradually. The things that are really at home are what you can say are the landmark projects. They are not necessarily the biggest in the world, but some are. What is current, where is the most recent experience, what are the landmark projects in the world—those are the things that

generally are going to foreign ownership. That is what your reputation is built on.

**Senator Godfrey:** That is when there is no past technology.

**Mr. Newman:** There could be past technology. Usually there is.

**Senator Hicks:** Reference was made to James Bay.

**Mr. Newman:** Syncrude could be another.

**Senator Hicks:** I was not sure. Was this not sufficiently Canadian in the use of its consulting engineers?

**Mr. Newman:** Yes, in the overall project management. That is where the reputation will stand or fall.

**Senator Hicks:** I see.

**Mr. Beauchemin:** If we were to compete abroad with Bechtel (Canada) we would not be so worried. It is Bechtel (U.S.) we are going to be competing with. Regional offices, foreign-owned, do not compete abroad in their Canadian identity.

**Mr. Newman:** We do compete with Bechtel International. We do work in the States.

**The Chairman:** I would like to direct a question to Mr. Morrison. Because of our attention to other groups he has been rather silent up to now.

You were mentioning in your presentation that some of your people felt that they would like to follow through on certain projects and were not able to. What were the walls that they had to face?

**Mr. Morrison:** I think the walls are that it is exceedingly difficult to get fitted into existing programs. Let me give you an example. The National Research Council, for instance, has a program called PAIT, with which you are familiar, and this has a very sensible idea behind it. You find a group in a unit and a group in an industry that has common ground, working towards production of some common development. That is just fine. But now what do you do in the case of, as I cited, the photochemistry group at the University of Western Ontario. Here is a very anxious group. They would like to use their expertise. They are convinced, and I think one could put quite a lot of money on them, that here is something that will be of great value. Now, how can I interest industry in it, if I cannot specify at the moment what the device is? I suppose what I am trying to say is that now the programs that exist are not designed to back the brains, the new ideas. This is where the hangup is. They are designed to deal with things that we now know and that is reasonable.

**The Chairman:** But these walls, are they at the research level or the development level?

**Mr. Morrison:** Later.

**The Chairman:** The prototype.

**Mr. Morrison:** Yes.

**The Chairman:** Are you saying these people have launched companies?

**Mr. Morrison:** Lemieux has launched two companies.

**The Chairman:** Why wouldn't it be possible to get grants from the Department of Industry, for instance?

**Mr. Morrison:** He has had some support of that kind. I think the best thing would be to check with de Mayo, Kimmel, Belleau, and others like this. There are quite a few in the chemical profession. Another I would cite is Rapson in chemical engineering, in applied chemistry at the University of Toronto, who has been extraordinarily successful in assisting the pulp and paper industry measuring fibres and in dealing with the gleaning of effluence from pulp and paper mills. I think that he is perhaps managing at the moment, but it has been a very difficult job for him to get his ideas out where they are of value to us. This is where the hangup is.

**The Chairman:** That was said before this afternoon, before they go into exile.

**Mr. Morrison:** Yes.

**Senator Hicks:** I am not clear as to the nature of Professor Morrison's criticism, just the same. Is not all you are saying that some professors have the knack, the inclination and the drive to carry their theoretical discoveries through to a partial result, perhaps the incorporation of a company, and others do not?

**Mr. Morrison:** That's right, but it goes beyond that. The point I am trying to make is that I believe that we have not got the mechanisms, or whatever it is, that we need to detect these people and then try to twist our export schemes to take advantage of them because it is the new things that are going to advance us in relation to the outside world, and not copying what has been done elsewhere.

**Senator Hicks:** For example, I understand that a chemist working in natural products, Dr. Wiesner, has done some very significant work. Has this not been translated into practical products?

**Mr. Morrison:** It gets translated diffusely. That is, he does organic chemistry of extraordinary quality. It is extremely fine. Personally, I think he is not so much interested, although he did spend a limited period working with Ayerst McKenna in Montreal. On the other hand, it would be very nice if we had middlemen who were close to Dr. Wiesner to pick his brains.

**Senator Godfrey:** The evidence we have had, particularly from the government people, indicates that where they are falling down in Canada is as somebody develops something they have not got the administrative, marketing, developing skills after the original. There is the odd exception, and I suppose Dr. Lamb in the States would be the most outstanding example.

**Senator Hicks:** If Dr. Ronald Urie had stayed in his laboratory, instead of trying to build heavy water plants, it would have been better for Nova Scotia too.

**The Chairman:** I know it may not be in your field of interest, but I am just wondering if there would not be a role here for the consulting engineers in their relations between university people and industrial people in transferring that technology and suggesting there is perhaps something there for them. I do not know if this has been investigated.

**Mr. Newman:** It is a very good point, sir. We would have to get closer to the universities and closer to industry. It is a role we should be doing much more in.



**Senator Cameron:** I know a few engineers who have been successful in their private consulting work outside.

**Mr. Morrison:** This is a role that has been taken to some extent by Canadian patents and developments where they have used income from patents to support certain developments. They are in competition with some other bodies, for example, in competition with the research corporation that does the same thing.

**Senator Hicks:** I think many universities have arrangements with both.

**Mr. Morrison:** Exactly. That is where we are trying to field. Probably the main point I would like to make is the gap that I see. How do we get connected with these extremely good people we have, because they are the ones who are going to lead us? We have to follow them. We do not plan things and then expect them to fit in. I think it is the other way around. They are the ones with the ideas, and it is the ideas that are to be exploited.

**The Chairman:** In other words, we are back to mechanisms. We discussed that this morning, but the professional engineers were against our emphasis on mechanism.

**Senator Bell:** There were some outstanding organic chemistry people graduating in Eastern Europe. They brought them to Berne, where there was no such industry, and it now has the biggest pharmaceutical centres in the world. They earn nothing but money for Switzerland.

**Mr. Morrison:** I cannot really speak to this with any substantial knowledge behind me. But I am aware that for a couple of generations there have been excellent organic chemists in Swiss universities. This is the first thing you need. There have been entrepreneurs, Hoffmann-LaRoche, CIBA, and others, who have then taken advantage of that, and certainly young organic chemists coming out of institutions in Switzerland go into these industries.

**Senator Bell:** The initiative has to come from the starting point.

**Mr. Morrison:** Putting what I have been trying to say another way, I think you need to start that.

**Mr. Morrison:** Putting what I have said another way, I think that you need to start a background of high quality and in Switzerland that has existed. I would like to suggest that in Canada we are now getting close to that in the subfield of organic chemistry and this is something that we should exploit, yes.

**Senator Bell:** Would the Wellcome Foundation in Great Britain have any application to that? It takes all the profit from whatever its business end of the field is, and turns it back for research and development and basic research. Could we do something such as that?

**Mr. Morrison:** I know very little about that. I am aware of the existence of the Wellcome Foundation, but not just as to how it functions. However, certainly the research corporation has the philosophy that the income from patents is ploughed back into research.

**Senator Hicks:** I think that Professor Morrison has made a very good point, which I for one understand better now than I did at the beginning of this discussion. It is that where there is high scientific competence in the laboratory we should ensure adequate mechanisms to translate this

into practical products which will add to our industrial productivity, business enterprises and everything else.

**Mr. Morrison:** I believe this is the logical follow-through of an investment.

**Senator Hicks:** While there may be one scientist who will do this for himself, there may be another equally good in the laboratory who will not, and we must find a mechanism to see that the results of his work get translated into something.

**Mr. Morrison:** I would have exceedingly great difficulty in differentiating between Lemieux and Wiesner on their scientific competence. They are exceedingly good.

**Senator Hicks:** Yes; one has carried his into the marketplace and the other has not.

**Senator Lang:** Does the chemical industry make a contribution to research and development?

**Mr. Morrison:** I think if you add it up, there is quite a significant Canadian industrial research component, yes.

**Senator Lang:** I mean contributions to the universities.

**Mr. Morrison:** Yes, they certainly support research, but it is not nearly on the scale that research is supported by the National Research Council, for example.

**Senator Lang:** You are really looking for very high-risk money, are you not?

**Mr. Morrison:** However, to be fair to the private sector, one should point out that many industries contribute general funds to universities. For example, McMaster University receives quite substantial support from the Steel Company of Canada, Dofasco and so on, which is terribly important.

**The Chairman:** What is the situation with respect to the drug industry?

**Mr. Morrison:** I do not know; I have not that at my fingertips.

**Senator Godfrey:** Talking about chemistry and the statement that the consulting engineers in Canada have the competence to do any jobs, recently Dow Chemical has put together a \$600 million project in Alberta. Where would they look for consultants for that work? Is there anyone in Canada who can do that and has had past experience of that type of project?

**Mr. Newman:** You would have to look at it on several different fronts. First of all, there is the project manager who must know something about the field, then there is the front end technology, and then the engineering. The front end in that type of process might be imported or it might be the property of Dow. They might not wish you to have it, in fact. The key is the project management with sufficient ability to understand the project and bring someone in on the front end, and with that type of project a consortium is usually formed.

**Senator Godfrey:** Have they brought personnel in from the United States?

**Mr. Newman:** We do not know that.

**The Chairman:** I believe you put some emphasis on your remark with respect to the "make or buy" policy in connection with existing intramural programs.

**Mr. Newman:** Gradually.

**The Chairman:** Do you understand that this would be quite difficult to do?

**Mr. Newman:** It would mean a fundamental shift in attitude. That says that the size of the government establishment should be gradually reduced, yes.

**The Chairman:** It means, also, the transfer of researchers and scientists from the government to the private sector and apparently this is very difficult to achieve.

**Mr. Beauchemin:** It is worth trying.

**Mr. Newman:** I do not believe anyone has ever tried.

**The Chairman:** We are told by government personnel that once you are a civil servant, even in research, it is impossible, or very difficult, to get out. That is the reason they have to keep all these in-house programs, to keep them—

**Mr. Beauchemin:** To make work.

**The Chairman:** To keep their staff busy.

**Mr. Newman:** Excuse me, sir; that is a hell of a rationalization for a science policy.

**The Chairman:** That is what we are being told.

**Mr. Beauchemin:** That is why we say they should not fire those on staff, but have no new starts.

**The Chairman:** If, for instance, an existing program were transferred, would it be possible to transfer people also?

**Mr. Newman:** Allow me to give you an example. Suppose the government were to contract for the management and operation of the Bedford Institute or the Pacific laboratory equivalent, I believe that the private sector—I am not just talking of consulting engineers—could take that on and manage it, using the existing establishment, and quite possibly do a better job. That would be an example in which the fundamental location and nature of the work would not be changed, but the management of it may be changed and at that point it moves out of government.

**Senator Lang:** Do you mean contract?

**Mr. Newman:** Yes.

**Senator Hicks:** Would that extend to the policy determinations insofar as there is any influence exercised from the top down on the nature of the programs that are going to be undertaken at the Bedford Institute, for example? Surely, the government has to retain the right to intervene to this extent?

**Mr. Newman:** I think government would have the right, sir, but I also think that there would automatically be much more consultation with the private sector as to the intent of the programs. In other words, there would be a check and balance, which is missing at the moment. This is one reason for not having as much technological transfer as we should have. If the private sector were administering this kind of thing and it were set up so that it would hopefully operate at a profit, and the government came forward with something, there would automatically be some good soul searching as to how that was going to be transferred.

**Senator Hicks:** But the government through the Bedford Institute gives the Dalhousie Institute of Oceanography all that ship-time free. If you people managed it, we would never get that.

**Senator Godfrey:** At page 8 of the brief appears the clause "seguing of technologies". I referred to the *Oxford* dictionary and found no such word. I then referred to *Webster*, an American dictionary and found a word, not spelled exactly the same way, of which I could not make much sense. It defines it as to pass from one musical theme to another.

**Mr. Newman:** It is a musical term.

**Senator Godfrey:** Is this part of the lingo of consulting engineer circles in Canada?

**Mr. Newman:** I do not think it is; it is a musical term.

**Senator Godfrey:** I am against jargon.

**The Chairman:** What are the relations between your association, the Engineering Institute, and the committee of deans and the professional engineers? For instance, I was struck this afternoon by a statement made by Dean Kennedy urging the government to effect the separation between the granting function of NRC and the labs and this morning we heard the professional engineers tell us that this separation should not be made. Yet we were told by the professional engineers that in the preparation of their brief there was much consultation with the engineering community. How do you reconcile these two points of view?

**Dean Kennedy:** I am not sure what the statement from the CCPE was on the difference of opinions on that issue, but, certainly, as far as the engineering deans are concerned, we believe that the new granting structure would be better than what exists presently, particularly in view of the fact that we now have the word "engineering" in on that Council. We recognize in Canada, apparently, that there is a difference between natural science and engineering, although if we go back to Rankin's time in Scotland, Rankin called himself a natural scientist, but he really was an engineer. We recognize that historically. Presently, engineering and natural science are different. I am not aware of what the point was that the CCPE was making this morning that they disagreed with.

**The Chairman:** They did not want this separation of function. They were agreeing with a minority of one on our committee.

**Senator Hicks:** I think I may have more support than that. I think you are being seduced by the fact that they have put the word "engineering" in the title. I do not think there is any other evidence that this change in the councils will improve the granting function at all. But as the Chairman is anxious to prevent me from developing this line of argument, I will stop at that.

**The Chairman:** I was just asking my question in order to know to what extent there was consultation in preparing views in the different groups.

**Dean Kennedy:** Not on that particular point, obviously, Mr. Chairman, but the National Committee of Deans of Engineering and Applied Science was an outgrowth of the groups which met with the Engineering Institute of Canada. This last meeting we had in June in Jasper was the first time in a period of six, seven or eight years that



we did have representatives of the Engineering Institute of Canada at our meeting as well as the ACEC. I think we are coming back together to realize that we are an engineering fraternity, and that we do have different sides to us. We have the EIC, the learned society; the CCPE, which deals with accreditation, professionalism; the ACEC, which is the business arm; and we are the educational arm.

**Senator Hicks:** On page 11 of your brief—and this would apply whether the National Research Council continues to perform its granting function itself or whether a new agency does—halfway through the second paragraph you say that “the time is opportune to review the operation, membership, title and number of the adjudicating sub-committees, and the criteria for the allocation of funds among these committees.” And I think you might also comment at the same time on your statement at the bottom of the page, which urges a “review of at least the major equipment grant and negotiated development grant programs be undertaken.”

Would you expand upon that a little, because I could not discern what lay behind your inclusion of those two statements in your brief.

**Dean Kennedy:** To comment on the first point, if you look at the allocation of funds among the 19 or 21 different NRC grant selection committees that we have, one would conclude after examination of the way the funds have been allocated over a period of ten years that the funds are allocated simply on the basis of history more than anything else. There is a certain change in the level of funding from year to year; sometimes it goes up imperceptibly and sometimes it does not seem to move at all, but it seems to be based in this way: that what your committee got this year is what your committee got last year. There is relatively little change in position among the funding of those different committees.

**Senator Hicks:** So in essence you are pleading for reconsideration of the relative merit of various disciplines or categories of research.

**Dean Kennedy:** That is right. We would question why Committee X, without giving it a name, might have twice the funds per applicant that Committee Y has.

**The Chairman:** Would this be your view as well, Mr. Morrison, in terms of the granting function?

**Mr. Morrison:** Maybe I could comment on the point that Dean Kennedy has just made. Keep in mind that for some years now the amount of money available has been in fact decreasing and you cannot increase one without decreasing the other one. So you have Hobson's choice, or whatever it is. Do you sack that which is paying off and which you have been supporting, in order to start something new that might or might not pan out? It is very difficult. It is an exceedingly difficult thing to do. If you have a logical development in research funds of the kind that Senator Lamontagne and others have been advocating, then indeed you can do what you advocate. I think, yes, but to do it the way things are at the moment is asking for the impossible.

**Dean Kennedy:** It is extremely difficult. That is why changes have been small.

**Dean Farnell:** To some extent this document is outdated, because the National Research Council has undertaken a review of the negotiated development grant program and has suspended all new grants. The comment here—and

they fully recognize this—was that these grants were set up as development grants, as seed money, and almost all of them had some provision that staff hired under the grant would be absorbed into the normal university budget at the end of the grant. That was fine in a period of expansion. But as soon as the universities' budgets became static that was no longer appropriate. The very nature of these grants has to be reconsidered. They can no longer be considered as seed money grants to buy facilities to hire staff which will then be absorbed into normal university budgets, because normal university budgets have great difficulty in absorbing any new activities, as you know.

**Senator Hicks:** Your fears as to the influence of the major equipment grants and negotiated development grants were that they might exert the kind of influence on a university which would turn it in a direction it otherwise would not take, and would commit it with a burden that it could not continue to bear.

**Dean Farnell:** I think so. I think the universities were finding it very difficult to undertake the commitments which were implied in these grants. Most of the grantees in the last few years have had difficulty meeting the terminal commitments that they made five years previously, with the assertion that they would absorb two, three or four staff members. They just do not have the budgets to do it. So it is necessary to rethink these programs, and this is being done.

**Senator Hicks:** This is a very pessimistic attitude you have taken, though. You are almost accepting the fact that we are in a continuing no-growth period insofar as not only universities and their budgets are concerned but insofar as research in Canada is concerned, and this is a position which I resist taking very strongly.

**Dean Kennedy:** I am glad to hear we are going to get more research money.

**Senator Hicks:** I am not a member of the government.

**The Chairman:** I thought you were making a special plea to go to Cabinet. You would be a very popular minister.

**Senator Hicks:** Those of us who are really concerned about research and development, whether in connection with universities and educational institutions or not, just cannot accept the fact that we are going to continue very long in a no-growth situation in Canada, and we must try on every occasion to make this point. Hopefully, ministers of government will ultimately listen to us. There is some little indication that some relaxation may be not too far off now.

**Senator Godfrey:** I saw something in the newspapers about a decrease in student enrollment over the next 20 years.

**Senator Hicks:** It is not a decrease. It is a decrease in the rate of increase.

**Senator Godfrey:** On page 11 of the brief of the Association of Consulting Engineers of Canada, they say:

We have helped to bridge the void between public policy and vested interests in Canada, a void that is so obvious when we look at the U.S. scene. The lack of this implicit arbitration function at the time of policy formulation has led directly to the politics of confront-

tation that blights the U.S. but that are relatively subdued in Canada.

When I read that I wondered just exactly what you were referring to. Every time we hear from somebody like the Canadian Chamber of Commerce or the Canadian Manufacturers' Associations or other business organizations, I get the impression that there is a strong confrontation between "private" and "government," and I just wondered exactly what you meant.

**Mr. Newman:** There is in those areas where we are not involved but where other people have been involved in prior consultation. I think the environmental field we have picked is a good one. There you have to do specific projects. For example, one of our firms did an incinerator in the Quebec City region. That one was worked out carefully with the local populace. There was complete freedom of information, complete consultation by the consulting engineers with all municipal councils, the media, and so on, and that process continued right through construction. If that had not been done, if they had gone in there and bulldozed the thing through without involving the engineers and the other managerial forces involved, there would have been quite a flare-up. When you are talking about specific projects, it is necessary to communicate with the community and explain things to them, and then, if there is any problem, the thing is defused to some extent. The point we are making is that if the same process were followed by the government on other levels and with regard to other issues, not necessarily involving us but other interested parties, and there were this more open type of consultation where contracting out is involved, we might have a lot less of this confrontation.

**Senator Godfrey:** For example, the sort of thing that took place around Pickering.

**Mr. Newman:** Pickering is a very good example.

**Senator Godfrey:** I am afraid I am nitpicking here, but I noticed on page 17 the following statement:

Motivation is an individual thing; one cannot motivate others (though one can always demotivate them).

I must say, as an ex-airforce person, that I was always told that part of the duty of an officer was leadership, and motivation, and so on. But you, having said that, did not even pause for breath before you went over to page 18 to say:

They will stay with us and will be motivated only so long as they find we offer a climate of opportunity. They will only be attracted to careers in technology and in the management of scientific and technological businesses if they can see positive indications of our growth, relevance and achievements on a world scale.

Is that not motivating by promising that kind of climate?

**Mr. Newman:** The point is that people motivate themselves. You cannot do it for them. You can, however, provide a climate in which they have an opportunity to motivate themselves. If you do not give them the climate, they can be turned off like that, very quickly. However, to go out and give a pep-talk and say, "You are now motivated," does not work.

**Senator Godfrey:** You mean all these sales meetings at 9 o'clock every Monday morning are useless, these Knute Rockne half-time pep-talks for football teams?

**Mr. Newman:** People have been motivated by such things, but for their own reasons. They see something useful in it.

**The Chairman:** There has been very little discussion with regard to the progress relating to unsolicited proposals. What is your experience in this field? You might all comment on this, because the universities are covered by this policy too. It does not seem to be developing in the way it was expected to, and I would like to get some reaction from you as to why it was not as successful as was anticipated.

**Dean Kennedy:** I cannot answer the question as to why it has not been so successful. The times it has occurred we have been very happy. I am aware of several at my own university where unsolicited proposals have been put in and have been accepted by DSS, and we are very happy with them.

**Mr. Beauchemin:** I would think that one of the reasons it has not been used too much is that there are certain criteria attached to it which are good but which do limit the possibilities. One is that you need a departmental client, and it is not everybody that will be sold on that idea. Then you need uniqueness, and there are not that many Canadian firms that are unique. It is a good program, but I do not think it is going to be the answer to everything.

**The Chairman:** No, but it seemed to me that it was a good adjunct to the "make or buy" program.

**Mr. Newman:** It is excellent.

**The Chairman:** Because with the "make or buy" program you have to adjust to the needs of the departments, or a client, as they proceed with those needs; but the unsolicited proposals give you the opportunity to help detect the gaps in the client's needs, so that it is a more positive contribution that you can make there.

**Mr. Beauchemin:** It is excellent, because it got rid of the argument that there was no money left in the project to do it. People would say, you know, "It's a good idea, but there's no money."

**Mr. Newman:** People are coming up and they are responding, so it is good. I would say the main weakness may be on the private sector side or on the university side. Not enough of us are coming forward with ideas. I do not think the limitation lies in the program. It is a good one.

**The Chairman:** I am glad to hear that, because this is not a view that we have very often.

**Mr. Beauchemin:** It is not that well known, either, yet.

**The Chairman:** You feel that it is not very well known as a program?

**Mr. Beauchemin:** It is known to a point, but it is still new. Until your people do something about it, and see that it does work, it is always going to be something that is new.

**Mr. Newman:** Even the "make or buy" program is something that we get a number of complaints about. Some of them are fundamental issues, but an awful lot of them arise from the fact that people do not know it. They do not know that they can contact DSS directly, and so there is a lot of griping going on. There is a great deal of public



relations work to be done, and it is something along these lines we are trying to do.

**The Chairman:** I suppose MOSST has helped in that respect, too, through their recent publications, which I suppose have been properly distributed through the community.

**Mr. Newman:** Everything helps.

**Senator Yuzyk:** How does the Association of Consulting Engineers relate to MOSST, if at all?

**Mr. Beauchemin:** One way we do relate is through the R & D Committee, and perhaps Mr. Newman should answer that.

**Mr. Newman:** We have had pretty close relationships, in particular with Peter Meyboom. We were asked to put in a brief on "make or buy", which we did, and through our R & D Committee we got together with them frequently. We do this two or three times a year.

**Senator Yuzyk:** Is it at their initiative, or yours, mainly?

**Mr. Beauchemin:** A bit of both, I imagine. The precedent was set a while ago, so it has been running for a while.

**Senator Yuzyk:** It is a cooperative effort.

**Mr. Beauchemin:** I would say so.

**Senator Yuzyk:** How about the Chemical Association?

**Mr. Morrison:** Mr. Michael can speak to this.

**Mr. T. H. G. Michael, General Manager, Chemical Institute of Canada:** The relationship of the Chemical Institute with MOSST has been pretty much as the consulting engineers described it. That ministry has invited the institute to take part in certain studies, and we have responded. In one or two cases we have proposed certain studies to which MOSST has responded. The entire exchange is not at an extremely high level quantitatively, but we hope that it has been helpful to the minister, and we feel that it has given the institute, and through it the institute's members, a little better idea of what the ministry is trying to do.

**Senator Yuzyk:** Would you offer any suggestions as to how to improve relations?

**Mr. Michael:** The suggestions that I would offer would be more in the way of hoping that MOSST could make much more plain to the whole scientific engineering community precisely what it is trying to achieve, and, in so doing, enlist the support of those communities and its aims. The ministry, in my own view, is certainly much too secretive in these areas.

**Senator Yuzyk:** Would the consulting engineers share that view?

**Mr. Beauchemin:** I would ask Mr. Ian McCaig to comment on this subject. He has something prepared.

**Mr. McCaig:** I feel that our conversations with MOSST have been good. We have given them examples, in many cases, of the multiplier effect of this "make or buy" on various companies and businesses. But I feel that in this coming year, when I am looking after the committee, trying to do as well as Dave Newman did, that I will make it my prime objective to get near to MOSST and find out

exactly where they fit into the picture and how we can work more closely with them.

**The Chairman:** In other words, there has been a good start, but you feel that it has not yet produced all the results that can be expected.

**Mr. McCaig:** I would like to go back to the question about unsolicited proposals. One of the problems with unsolicited proposals—and I would like to draw your attention to this—is that it is very difficult to make an unsolicited proposal unless there has been a conversation previous. You do not know a man's problems unless you have spoken to him. The "make or buy" policy has really only been in effect for about three years. We really have not got that conversation going properly. In another year or two I think you will get much more contribution from consulting engineers and others making proposals of their own to government.

**Senator Carter:** The chemical industry is a vital industry for Canada, and it depends on resources that have become scarce. What are you doing? Are you negotiating with the federal government to have a guaranteed supply of these resources?

**Mr. Morrison:** This is something that I think the chemical institute of Canada, as a professional society, cannot respond to because it is not involved in manufacturing or anything like that.

**Senator Carter:** Who is doing it for the chemical industry? Is anybody doing it?

**Mr. Morrison:** It seems to me that organizations such as the Chemical Production Association and the Canadian Manufacturers' Association are concerned specifically with that sort of thing. This group is a body of chemists, chemical engineers and technologists, who have grouped together for various purposes. But none of them is to negotiate with the government to do anything like that. Certainly various members of the institute are concerned about supplies of raw materials. This goes get discussed at symposiums and meetings and that type of thing of the institute.

**Senator Carter:** As an institute, are you concerned with the supply of manpower, chemists?

**Mr. Morrison:** Yes.

**Senator Carter:** How is your supply at the present time, and how do you see it in the future, the next four or five years?

**Mr. Morrison:** That is a very short time to look at. At present there is no doubt that there are more people available than there are jobs consistent with their qualifications, and so on. But it is very difficult to predict what happens because you are, on the one hand, dealing with an education cycle, which is maybe eight or ten years in duration, or something like that, and an economy cycle which certainly does not have a characteristic time that long. It is very much shorter. You may be able to say some things for the long run. University presidents have to worry about enrolment and you, Senator Hicks, must have at your fingertips what the projections are of enrolment in universities.

**The Chairman:** It is always going down at Dalhousie.

**Senator Hicks:** It is amazing how quickly these imbalances develop. I suppose the profession that illustrates this most dramatically is the engineering profession. You people have an absolute genius for an over-supply or under-supply. The average length of the education of a professional engineer is much shorter than the research chemist who goes on to his PhD degree. So engineering students respond to a much shorter time swing.

**Mr. Kennedy:** Even at the times when we were accused of having a tremendous over-supply of engineers, the over-supply was only in the order of a few per cent.

**Senator Hicks:** And it did not last for very long.

**Mr. Kennedy:** That is in contradiction to an over-supply of our colleagues which meant only a smaller per cent of their graduates were getting jobs.

**Senator Hicks:** The greatest over-supply is experimental psychologists trained to the PhD level, but no one seems to worry too much about them.

**Senator Carter:** I have another question regarding engineers. In your verbal presentation you deplored a government getting bigger and you make the same point towards the end of your brief. But on page 2 you say:

The private sectors of society have not provided moral, economic, or technological leadership adequate to our times. Government has inexorably occupied this vacuum.

I have been around here now since 1949. I have not seen government get into business because they wanted to. It is not very often. Mostly they have had to get in because of public pressure or because private enterprise would not or could not do what needed to be done or because private enterprise just neglected its responsibility to society and the country. That has gone on for 27 years, since I have been here. I do not see any way of changing it. Do you?

**Mr. Beauchemin:** We were speaking in the past tense when we said we were not doing it. It is our process to try and give our point of view. I feel the only way is through an association such as ours; instead of being part of the majority, to be part of the vocal minority and give our point of view. This is what we are doing today.

**Senator Carter:** Complaining is not going to get the results you want. As long as the vacuum is there, someone has to occupy it. If no one else will, the government is forced to. Everybody complains about big government interfering everywhere. All business people are complaining that way. My experience has been that government is caught between the devil and the deep blue sea. They have no choice in most cases but to do it.

**The Chairman:** Do you not think, Senator Carter, looking through the brief of the consulting engineers, that there is a new tone there compared with a few years ago? There is much more of a social consciousness than before. They might be prepared, at least as far as this circular is concerned, to face their social responsibilities, as well as their professional responsibilities, more than in the past.

**Senator Carter:** Certainly that passage on page 2 implies that they recognize there is a responsibility there. But you have got to go a little further than that. How are you going to get this out to the public at large?

**Senator Godfrey:** I really found it most refreshing where you say at page 22 of your brief:

This will require many more of us, individually and corporately, to act with more courage... to take the risks of building the future without demanding government guarantees and support at every turn.

At page 23 you say:

... self-help is more the rule than the exception.

I found that so refreshing in contrast to the Canadian Chamber of Commerce, the Canadian Manufacturers' Association, who came here and said, "We want all research and development subsidized by the government, whether we do it on our own, without subsidy, or to the extent of a 35 per cent tax credit," which is like handing them money. What we need is more people like you making those statements. If you do, we will have a better climate. If more people complain, particularly organizations like the Canadian Chamber of Commerce, about government interference, their terminology for regulation, they come out with both hands out, as Senator Carter says, and want these hand-outs.

**The Chairman:** I think with these congratulations, which I am sure would be supported by all members of the committee, at last we should come to an end because I do not think you will get better congratulations than those you just heard from Senator Godfrey.

**Senator Cameron:** We can see their halos growing.

**The Chairman:** Thank you very much.

**Senator Godfrey:** Congratulations from me are very rare.

**The Chairman:** We hope you will forgive us for this rather crowded meeting this afternoon, which was due to the rescheduling of our hearings.

The committee adjourned.







## Appendix "38"

THE ASSOCIATION OF THE SCIENTIFIC, ENGINEERING & TECHNOLOGICAL COMMUNITY OF CANADA  
L'ASSOCIATION DES SCIENTIFIQUES, INGENIEURS ET TECHNOLOGISTES DU CANADA

SUITE 202, 151 SLATER, OTTAWA, ONTARIO, CANADA K1P 5H3

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HISTORY OF SCITEC

SCITEC was established in answer to a question raised by Senator Grosart, at the hearings of the Special Senate Committee, On Science Policy, on June 5, 1969.

"Where do you see the whole science community itself developing a mechanism for the in-put of science into the layman's political decision which has to be the first decision in the funding and therefore to a great extent the direction of science policy?".

The Carleton Conference, the Founding Conference, held July 31 - August 1, 1969.

THEME: "How can the Scientific and Technical Community make its Maximum Contribution to National Decision?".

MOTION:

"This Conference expresses its urgent conviction that an organization representative of Canadian Science and Technology be established".

SCITEC Established - Ottawa, January 16, 17, 1970.

SCITEC has organized the following Forums on subjects of interest to the scientific community and the public.

- HERITAGE TOMORROW - Halifax, August 1970.
- POLICIES AND PEOPLE - Changing Policies in Science and Technology. - Ottawa, June 1971.
- THE IMPACT OF SCIENTIFIC SOCIETIES - On Science, on the Community and on Society. - Ottawa, February 1972.
- A forum on Science Policy following the release of Volume II of the Lamontagne Report. PRIORITIES IN SCIENCE AND TECHNOLOGY, Energy: Its Social and Economic Implementations. - Montreal, May 1973.
- SCIENCE POLICY - Basic assumptions in the third volume of the Lamontagne Report. - Ottawa, May 1974.

- ISSUES AND PRIORITIES - Members of Parliament for the first time actively participated in this programme.  
- Ottawa, May 1975.

- SHAPING OUR FUTURE NOW - This is the first of a series of three annual forums on the theme "Research for Survival". This series is directed to both the industrial and academic world. Representatives from over forty companies attended the first conference. - Waterloo, Ontario. April 1976.

#### MINI-FORUMS

These forums are held following the autumn meeting of the SCITEC Council. Attendance is restricted to members of Council and invited guest participants who have demonstrated expertise in the subject of discussion.

- THE ROLE OF THE SCIENTIFIC AND TECHNOLOGICAL SOCIETIES

- Quebec City, November 1975.

#### PROJECTS

SCITEC has conducted under contract to the Science Council of Canada a study on National Scientific Societies which was published as Report No 25 of the Science Council of Canada, released in 1973.

SCITEC conducted under contract with the Ministry of State for Science and Technology a feasibility study for a Canadian House of Science and Tehcnology, this was released in 1973.

HOSTE is now in the process of being incorporated as a seperate identity and there is hope of obtaining a heritage building to house this operation.

#### PRESENT DIMENSIONS

There are 61 Science, Engineering and Technological Societies representing approximate 68,000 individual scientists. Over 350 Individual members and 5 Honorary Members.

THE BULLETIN

SCITEC publishes a quarterly periodical which serves to communicate with the membership and the general public. This also provides a method of communication between member societies and in a few instances scientific societies abroad. A copy of the current issue, June 1976, is enclosed.



Appendix "39"

A Position Paper on

"THE FUNDING OF ENGINEERING RESEARCH  
IN CANADIAN UNIVERSITIES"

by

The National Committee of the Deans  
of Engineering and Applied Science

September 1975

RECOMMENDATIONS APPEAR ON PAGES 18-19

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## INTRODUCTION

Over the past decade the analysis, definition, enunciation, rationalization and control of a "Science Policy for Canada" seems to have become a form of national sport among the scientific community. With a few notable exceptions, Canadian engineers have not participated very vocally in this debate even though their research and development activities will be affected by government decisions made under the umbrella of any science policy which evolves from the many studies in progress or completed. Realizing that the future of engineering research in their Faculties will be influenced by the attitudes of governments towards scientific research, and that these attitudes are now slowly crystallizing, the Deans of Engineering and Applied Science felt it to be timely to comment, under the heading of "Funding of Engineering Research in Canadian Universities", on some of the problems which they face in common with their colleagues in the natural sciences and on some of the differences which distinguish research in engineering from that in the traditional sciences. This position paper is not simply a plea for more money for research in the engineering schools. While it would be naive to assume that such an element was absent, we hope rather to argue for funding criteria which optimize the contribution of engineering research in the universities, and of the national resources represented by the engineering professors, to the development of Canada and Canadians. In the last decade engineering research in Canadian universities has matured, and it is now time for the engineering professors to assume more responsibility for a role as intermediary between national goals on the one hand and science policy on the other.

## II - FEDERAL SCIENCE POLICY

It will be assumed here that the following three expressed intents of the federal government are put into practice: (1) the reorganization of the granting councils, (2) the contracting-out of research to non-governmental laboratories, and (3) the adoption as the objectives of science policy "the rational generation and acquisition of scientific knowledge and the planned use of science and technology in support of national goals".

### 2.1 The Granting Councils:

In the forthcoming legislation, there are to be three granting councils each with a structure similar to that of the current Medical Research Council. Beside the Medical Research Council will be a Social Sciences and Humanities Research Council to replace the research granting function of the Canada Council, and the Natural Sciences and Engineering Research Council to take over the grants-in-aid and scholarship programs currently administered by the National Research Council. The latter will concentrate on the development of its laboratories but will continue with several of its other operations such as the Industrial Research Assistance Programme. It is the Natural Sciences and Engineering Research Council with which the Engineering Deans will be concerned primarily and perhaps this is the appropriate point for them to commend the Minister of State for Science and Technology for recognizing the differences between research in engineering and that in other scientific disciplines and for his personal efforts to include in his proposed legislation the acknowledgement of this difference in the title of the new council. (Rec.1)\*

Each council is to have a full-time President and some twenty members appointed by the Governor-in-Council "from among eminent persons possessing special interest or expertise in the fields for which their respective granting councils are responsible". There will be coordination between the Councils provided by an Inter-Council Committee which will not have any executive power of its own but will report to the Minister of State for Science and Technology. This Inter-Council Committee will harmonize the granting practices of the Councils and will ensure that adequate support is given to interdisciplinary research. It was proposed that the Inter-Council Committee be chaired by the Secretary of MOSST and include at least the heads of the Councils. The role of this Committee is not yet clear, especially in the allocation of funds among the Councils, because while it is to

\* The references in brackets are to the recommendations of Section VIII, pages 18 and 19.



report to MOSST, the Councils themselves will each report to an appropriate Minister. The peer judgement evaluation of research proposals is to continue and thus there will again be a system of sub-committees to do this evaluation.

## 2.2 Contracting-Out:

The "contracting-out" policy was set forth in 1972 with the hope that the resulting increased conduct of research in industry on behalf of the federal government would strengthen the research capability in Canadian industry and lead to the creation of new and ongoing jobs both by the research itself and by the spin-off product development which results from having the research done closer to the product consumer. According to this policy all new federal government research programs are to be assessed and whenever the capability to do the work exists within industry the research is to be contracted out, but the word "new" is left open to interpretation. The few intended exceptions include cases where the research and development needed is "inappropriate" for industry, where no suitable industrial capability exists and it would not be of optimum benefit to Canada to create one, where the R and D is essential to provide direct support to a regulatory function and where no private establishment can be found or created, where the R and D is essential to the maintenance of national primary standards and central testing services, and where the R and D is essential to maintain a limited in-house competence sufficient to assess the opportunities represented by the current state of the art to enable the operating department to perform its mission. The policy was given five years to become effective; we are at the mid-point of that period.

The universities and other non-profit institutions are permitted to participate in such contracting only as sub-contractors to industry or when no competent company responds. The program is administered by the Science Procurement Division of the Department of Supply and Services, a group which has expanded rapidly and has collected into its operation many of the other science procurement programs formerly conducted under subvention programs.

There also exists federal programs of various types for the reception of unsolicited proposals from industry and from universities. A few of these programs have budgetted funding, but most do not, and contracts resulting from such proposals must come from the operating budget of an interested government department.

### 2.3 General Policy:

It is important to note that in the Federal Government's statement of science policy, above, there is included the concept that science and technology are national resources and that their use should be rational and efficient as with any other resource. Thus, while the Government supports the importance of basic research to the cultural identity and to the long range maturity of Canada, it recognizes the need for oriented research directed towards national goals. National goals have been defined in broad terms, energy, transportation, communication, etc., but they have not yet been interpreted into a form to make them directly useful as criteria in research project evaluation and funding.

### III — ENGINEERING RESEARCH

#### 3.1 Two Roles of Engineering Research

In defining the profession of engineering itself, it is usually noted that it includes the application, with judgement, of the findings of the natural and mathematical sciences in the development, for the advantage of man, of economic methods of utilizing the materials and forces of nature. The roles of engineering research are then to provide the concepts and data to reinforce the activity of engineering under this definition and to provide also much of the underpinning. In providing the underpinning, engineering research is closely allied to oriented scientific research in the attempt to structure and influence the development of emerging concepts and thus it is not anomalous to find that one part of engineering research can be classed as basic research.

Design which is the core of engineering is an iterative decision-making process involving the establishment of objectives and criteria, the complementary use of synthesis and analysis, construction, testing and evaluation. At any one time, the professional engineer is usually concerned with producing one particular product, service, or process, but the generalizations to other products and other processes are often of greater importance than the original. It is here that engineering research plays its second role of integrating the results of many special cases into general models and principles and in this type of synthesis it is easily distinguishable from classic scientific research. Thus, while in many cases engineering and scientific research overlap, their centroids are separate and engineering research is marked by the common thread of "design" which is almost always apparent and by an emphasis on systems, optimization, and orientation.

#### 3.2 Engineering Research in Industrial and Government Laboratories:

Since most of the knowledge of modern technology resides in industry, it would seem logical that the largest concentration of engineering research would also reside in industry. It is surely one of the obvious weaknesses of most Canadian secondary industries that this concentration is not adequate for the needs of a country which wishes to trade in high technology products. Good engineering research will not alone create an internationally competitive Canadian industry but it is usually a key element. The Engineering Deans support the policies, programs, and attitudes of the Federal and Provincial Governments which encourage the development of the engineering research potential of Canadian industry. (Rec. 2)

The national benefits to be derived from engineering research carried out in government laboratories are somewhat more difficult to identify. There is an obvious need for a goodly number of active government research engineers keeping abreast of the current state of technology in order to provide a pool of hopefully disinterested expertise to advise government on technical matters. Similarly many large research projects require an appreciable government presence, but arguments concerning the efficiency of having complete decision and execution under the roof of one government department do not seem to justify the establishments necessary to maintain such projects in-house. The transfer of technology from government laboratories to the market place has suffered so many impediments that it has been difficult for the country to reap the benefits of much of the intramural expenditures. Surely, it cannot be best for the long-term economic development of the country to continue to have intramural research account for over 50% of the Federal Government expenditure on Research and Development, and to continue to have large research spenders such as the Departments of the Environment and of Agriculture devote well over 90% of their scientific activities' budget to intramural work. While contracting-out appears to have minutely reduced these fractions there is not yet evidence of any gross change even though the channelling of external expenditures through the Department of Supply and Services has made such expenditures more readily identifiable. (Rec. 3)

### 3.3 Engineering Research in Engineering Schools:

It is the scholarship, the creation of new knowledge and the synthesis, in short, research, which distinguishes the universities from the other components of the educational systems of the different provinces. Because of this research, the universities are not like the other educational institutions and they have responsibilities which go beyond the education of the pupils who are within their walls at any one time. Many are the advocates of research in general within the universities, so we can restrict our discussion to research in the engineering schools. Engineering research was divided above into two categories: the basic work underlying, though not always chronologically preceding, the design phase; and the generalizing and synthesis work paralleling the design activities. Both of these categories have a place in the engineering school.

It has been estimated that Canada contributes less than 3% to the international pool of scientific knowledge but it is the individual contributors of this small fraction who have ready access to the remaining 97% through personal contacts and general awareness. The same distribution is probably applicable in technologically-based fields and again the contributors of new ideas have access to the ideas of others, and thus Canada must support the more basic aspects of



engineering research. An appreciable fraction of this type of engineering research can be done with efficiency in the engineering schools because the university professor is not so constrained by delineated objectives and product deadlines, he has ready contact with colleagues of other disciplines, he is constantly spurred by ingenuous comments of graduate students, and his lack of proprietary interest often makes him more freely accepted nationally and internationally. For every engineering professor actively pursuing good research, Canada has a disinterested expert observer of all international developments in that field.

Much of the synthesis function of engineering research can also be performed efficiently by engineering schools because the professor has the freedom to look to generalizations, and the very nature of his teaching function encourages this type of activity; the teacher always seems to prefer to discuss broad principles rather than narrow examples, especially if he has developed the principles. However, this synthesis and creation of general models is not an ivory-tower activity and the engineering professor in such a role must have ready access to current industrial solutions to related problems and access to facilities which allow filling of the knowledge or data gaps in the postulating and testing of the model he is creating.

There are several internal advantages to research in the engineering schools which in turn have external effects mainly through the influence on the attitudes and abilities of the graduate and undergraduate students. It is of vital importance that an engineering school be collectively knowledgeable of the current state of technology and this state of awareness comes through the research and professional activities of its individual professors. It is not necessary that every engineering professor be engaged in research, indeed it is wasteful that the unsuited be encouraged to do so, but each must be immersed in an environment in which today's and tomorrow's industrial problems are under knowledgeable review. The professor with research ability who wishes to do research work should have access to funds adequate to allow him to contribute these talents to the community. Thus, the development of better and relevant teaching across the school is an important consequence of good engineering research, though it must be admitted that research does not increase teaching ability in every individual case.

During the expansion phase of most Canadian engineering schools, experience in and contacts with industry were not major criteria in the hiring of new professors. However, the importance of this lack of industrial involvement can be seen to be well recognized in some areas by the engineering professors themselves who are now remedying the situation through industrial contracts and through leaves and sabbaticals with industrial companies.

This may be the appropriate point to indicate another significant difference between research as an activity in the engineering departments and in the science departments; the apprentices produced by the former are destined primarily for positions in industry and government and in fields different from that of their thesis work, that is, they are not intended to reproduce their supervisors. There is a growing acceptance of engineering PhD's in Canadian industry, in part due to NRC programs to encourage this acceptance, however, it is important to note that in contrast to most of the sciences, the Master's degree is a very respectable terminal degree in engineering, and the additional exposure to research or design beyond the Bachelor's level in an active engineering department produces a more technologically aware graduate.

## IV - SOURCES OF RESEARCH SUPPORT

The two main types of research funding are grants and contracts. A grant is really the only satisfactory method of supporting purely curiosity motivated research, but on the other hand grants can be used also for oriented research. It would appear that the main feature which distinguishes a grant for oriented work from a contract is that the report to the sponsoring agency on the former does not in itself disseminate the results of the research but is a post-facto justification for the award of the grant. On a contract, the reports and perhaps the prototype unit are of themselves important to the sponsor. The sources of grants and contracts for the universities include the Federal, Provincial and other governments and their agencies, industrial companies, and non-profit organizations. The grants-in-aid program of N.R.C. has been the largest source of direct operating funds for research in the Canadian engineering schools. Several of the provincial governments, especially Quebec, have significant granting programs and all of the provincial governments contribute in one way or another to indirect research costs.

The Defence Research Board's extramural program was also a significant source of grants and the sudden departure of this innovative program will leave a large funding gap in many engineering research groups, and it is to be hoped that the funding withdrawn from the D.R.B. program will reappear as an explicit supplement to the funds available to the new granting Council. (Rec. 4)

Contracts with industry and more particularly with government agencies are a growing source of research support in the engineering schools. There are many problems presented by these contracts as a form of funding because they impose restrictions to which the universities have not been accustomed: deadline dates for formal reporting, orientation and pacing of work, conflicts of interest for graduate students, proprietary interest in results, etc. Fortunately these restrictions have not been foreign to engineers and thus the engineering departments have in general welcomed the increased number of contracts available, and university administrations have been understandably willing to accept the direct overhead payments thereby provided. Almost without exception the engineering departments of Canadian universities can selectively undertake more contract research without distorting their operations, but each must be continuously alert to the maintenance of a balance such that contract research does not become an end in itself but remains an intellectual activity and subsidiary to the primary functions of the department.

It is generally advantageous to have the research in any one department and perhaps even of any one professor supported by funds of several different types and from several different sources. Besides the obvious hope that more sources will produce larger total funds, breadth of support allows diversification and change of emphasis as the field changes, guarantees continued support salaries by overlapping contract spans, provides flexibility to follow promising ideas, demands broader contact with the outside world, protects against the effects of the sudden termination of a contract, and in some sensitive areas renders results less suspect because they are not financed by a single sponsor. (Rec. 5)



## V - THE NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL

The initial membership of this Council will obviously have a strong influence on the direction to be followed for many years by its various programs. While this membership should and probably will be dominated by academics, the Engineering Deans hope that the membership will include people of broad expertise and sound judgement from outside the universities who are sympathetic to and knowledgeable of the economic and industrial needs of the country. Such talent could be found in industrial research and development activities or in government laboratories. This Council will not necessarily have concerns about the economic health of the country written into its terms of reference, nor will it have a set of operating laboratories under its wing to keep it nationally informed on the current progress and pitfalls of technology. Thus, the terms of reference and the initial membership must be chosen to ensure that the Council adequately performs both of the mandates implied in its title and the Engineering Deans would be pleased to suggest prospective candidates. (Rec. 6)

The peer judgement system for the award of operating grants as practiced by N.R.C. is in general the most suitable for operating this form of grants program. Since many changes in the details of the granting program will be required by the reorganization of the granting councils, the time is opportune to review the operation, membership, title and number of the adjudicating sub-committees, and the criteria for the allocation of funds among these committees. We hope that the new Council will undertake this review as one of its first tasks, that it will consult widely as part of this review, and that a similar review will be repeated periodically say every seven years. (Rec. 7)

In Report No. 18 "Policy Objectives for Basic Research in Canada" the Science Council suggests that scientific research proposals should be judged against two separate sets of criteria: 1) internal criteria which concern the importance of the work proposed to the appropriate discipline and to neighbouring disciplines, the soundness of the proposal, and the ability of the proposer to succeed with it; 2) external criteria related to the relevance of the work, the side benefits, the possible adverse effects, and the cost. The Deans of Engineering are in favour of the inclusion of a similar double set of criteria in the evaluation procedure for at least the engineering committees of the new granting Council, and we feel that similar criteria could be beneficially applied by all of the committees and even in the allocation of budgets among the committees. (Rec. 8)

There are several other current major granting programs of N.R.C. which influence the engineering schools and we recommend that review of at least the major equipment grant and negotiated development grant

programs be undertaken. One important consideration in the review of the terms of reference of the latter and of similar very desirable seed-money programs is the influence on them and vice versa of the now static nature of the establishments of the engineering school staffs.

While on the whole it is probably advisable that the Inter-Council Coordinating Committee not have any executive power of itself, difficulties can be foreseen in its role of promoting interdisciplinary research and "seeing that it has adequate support", Biomedical Engineering seems to have suffered already from this problem of undefined sponsorship. As its name implies, the Inter-Council Coordinating Committee is to provide for cooperation between the three granting councils, but perhaps more important it should also provide positive leadership in funding policy for federal grant-based research. Since its executive power resides in the individual councils, both the co-operation and leadership aspects would probably be enhanced by limiting the membership of the Inter-Council Coordinating Committee to the Secretary of MOSST, the heads of the three councils, and a representative of the Treasury Board. (Rec. 9)

The Deans of Engineering support very strongly the maintenance of a peer-judged grants-in-aid program directed towards the individual university professor much along the lines of current N.R.C. university grants program. While we are recommending a review of the details of operation to ensure optimum performance and, in Section VII, a more realistic level of funding, we recognize that this program has provided the core of research funding in our departments and must continue in this role despite increases in more mission-oriented work. (Rec. 5 to 8) The breadth of outlook and expertise of the peer committees necessary to ensure quality is just not available on other than a national scale and thus the program must be continued under the aegis of the new Natural Sciences and Engineering Research Council.

## VI - CONTRACTING OUT

The contracting-out of government research is in general more beneficial to the country than performing a similar amount of research within government laboratories. This statement becomes even more true as the character of the work has more the flavour of development than of basic research. The Deans of Engineering hope that their departments will have ready access to contract competitions for research work done for federal government departments, and they will endeavour to ensure that all such contractual arrangements with members of their staffs which involve the professor's university or engineering school in any way are made "through the front door", that is, with the full knowledge and consent of that university. They will also try to make available to government departments negotiating contracts, the appropriate university or engineering school policy with respect to the approximate external time commitments allowed for the staff members concerned.

We are here discussing research activities which use university facilities and not the professional activities of the professor as an engineer. The latter is not a three-way agreement though future embarrassment might be saved if the government department employing the professor as a professional consultant knew the policy, with respect to outside activities, of the professor's faculty.

Clauses which prevent universities from competing for contracted-out research when any one company, almost regardless of its expertise, has bid are not beneficial for the country, provided of course that the university uses realistic costs in its competitive tender. Such barring of front-door tendering leads to the establishment of quasi off-campus companies which sell university services indirectly.

The Deans of Engineering would also like to see greater encouragement of and funding for unsolicited proposals, in part because availability of contracts of this type are less constraining on the direction of research in the engineering schools than are the solicited contracts because they allow "free" research to proceed in the confidence that there is a reasonable chance for adequate funding if it shows signs of success. The concept of unsolicited proposals also allows the shopping for a sponsor to be done to some extent by the Department of Supply and Services, but more important, perhaps idealistically, it may allow industry and universities a means of telling government what they think are potentially significant technological problems. They must be "significant" because the proposer has already invested other funds in the preliminary study. (Rec. 10)

The contracting policies of the government departments should make it convenient for university departments to participate in the contracts awarded to industry. We do not want to "freeload" on government-industry contracts but we believe that there is talent available in our engineering schools which is probably under-utilized yet would be useful to both parties of such contracts. There appears to have been cases already in which slight changes in the contract wording would have facilitated university involvement to the benefit of all.

As noted previously, the contracting-out policy has produced little fractional change to date in the federal research and development money spent on purchasing extramural research, moreover a fraction of the order of one half of the industrial research contracts under this program has been with service organizations and thus has probably not created new on-going jobs but shifted employment from one sector to another. While the number of research contracts channelled through the Department of Supply and Services to the universities has increased, there appears to be little increase in the number of government contracts awarded to universities.



## VII - GENERAL

It is difficult not to comment at least briefly on the general level of funding of research in Canada. When normalized to such economic indicators as Gross National Product, the expenditures for research and development for Canada are about one half of those of the leading industrial nations and it is doubtful if the gross Canadian expenditures are even keeping pace with inflation. For example, over the three years 1973 to 1975, the increase in federal expenditures on all scientific activities in the natural sciences averaged only 7% per annum, or it can be noted that while the total payment for research in the natural sciences to Canadian universities and non-profit institutions from all federal departments and agencies increased by some 17% in current dollars over the 1969-1975 period, the value in constant 1969 dollars actually decreased by some 14%, moreover the amount of research activity purchaseable by the N.R.C. operating grants program has decreased by a much larger fraction over a similar period. Thus, while all the debate has been in progress regarding science policy in Canada, the position of the scientist and research engineer has steadily deteriorated. The real deterioration is even greater when account is taken of the sophistication factor in experimentation, the complexity of the instrumentation required to advance knowledge is increasing steadily.

The Deans of Engineering applaud the increase of funds made available to the N.R.C. grants program for 1975/76, bemoan the later partial retraction enforced by the Treasury Board, and believe that a realistic minimum funding level for this program under the new council would be a value which keeps the purchasing power constant at that of say 1970/71 multiplied by a factor reflecting both the increased sophistication of the work involved and, as far as engineering is concerned, the past inadequacy of the available funding which resulted from the late maturing of engineering research in the Canadian universities. The latter factor is somewhat arbitrary, but in our judgement should be approximately 1.3, a factor which with the inflation increase would maintain this program at its previous importance and allow mission-oriented research to be selected with careful attention to the intellectual content of the individual contracts. (Rec. 11)

Canada is embarking on many large engineering projects, in energy, in communications, in transport and in manufacturing plants, and it appears reasonable that as a national goal an appreciable fraction of the background research for and the synthesis work resulting from these projects should be carried out in Canada. The Engineering Deans thus encourage the sponsors of these large projects to allocate a small fraction of their expenditures towards the engineering research efforts of the Canadian part of the enterprise concerned, or of

potential or developed Canadian centres of related expertise. This small diversion of funds is likely to be a good investment as it will provide some of the basis for answers to the next generation of Canadian problems and the engineers ready to tackle these problems. It may well be that government intervention is needed to provide the incentive for multinational concerns to establish or better support Canadian research centres. It could be noted that the strong research complex of Bell Northern Research resulted from the intervention of a government. (Rec. 13)

The low level of communication and interaction between small Canadian companies and the engineering schools is surely detrimental to the possible industrial development of Canadian secondary industry. Much of the blame for the lack of interplay lies with the engineering schools, and the Engineering Deans themselves will seek means of fostering improved contacts with smaller Canadian companies, sharing of contracts is obviously one method and the encouragement of industrial sabbaticals another. (Rec. 13)

With the numbers of large engineering projects now contemplated and the increasing development of secondary industry, the long-term demand for engineers is unlikely to decrease, though the short-term needs may fluctuate in both number and type. The sophistication of Canadian engineering work is also increasing and necessitates a higher technical quality of the engineers themselves. This increasing scope and complexity of engineering in Canada will in turn place growing demands on the engineering schools as they keep pace with changing technology. With the current stable nature of the size of engineering schools, keeping pace with technology forces gradual self-retraining of staff and the latter is only possible through close technical liaison with industry and with government departments. Thus the main theme of this paper is an expression of the importance of research to the continued development of the engineering schools as a national resource and of the need to this end of a continued professor-oriented grants-in-aid program funded at a realistic level to be the core of the research funding of the engineering school departments, of a growth in carefully selected mission-oriented research projects, and of the involvement of the engineering professor with technologically advancing industries.

We have here been concerned with the national set of engineering schools and have refrained from discussing directly the role of the provincial governments in the funding of engineering research. Obviously, the policies of its provincial government with respect to university financing have a dominant effect on the ensemble of research activities within a given university, but there are other forums for the discussions of such policies. However, we do hope that the policies of each province will be such as to foster good engineering research and in particular to encourage the concept that breadth of support in terms of both type and source is beneficial to good engineering research. (Rec. 14)

## VIII – CONCLUSIONS AND RECOMMENDATIONS

The National Committee of Deans of Engineering and Applied Science:

1. Expresses its approval that the difference between research in engineering and in the natural sciences has been recognized in the title of the new granting council.
2. Supports the current programs for encouraging research activities in Canadian industry and would like to see them expanded in consultation with industry.
3. Urges that the contracting-out policies for research for federal government departments will soon lead to a significant increase in the fraction of the government research and development expenditures allocated to extramural laboratories.
4. Recommends that the funds previously distributed by the Defence Research Board's grants-in-aid programs be re-allocated to committees of the granting councils covering similar areas of research.
5. Recommends that policies of the federal government, the provincial government, and the universities themselves be such as to encourage diverse types and sources of support for research in the engineering departments.
6. Recommends that the membership and terms of reference of the new granting council recognize the needs of engineering research in Canada within both industry and universities.
7. Recommends that the new Natural Science and Engineering Research Council review the criteria to be used for distribution of the available funds among the discipline sub-committees and that such a review be repeated periodically.
8. Supports the use of peer judgement in the evaluation of applications for engineering research grants but wishes to see relevance added as a criterion.
9. Recommends that careful consideration be given to the funding of multidisciplinary projects especially ones which cross Council jurisdictions.



10. Recommends that steps be taken to increase appreciably the funding available for contracts arising from unsolicited proposals, and that the universities be allowed to participate more fully in the contracting-out programs of the federal government.
11. Recommends that in the short term the minimum level of the grants-in-aid programs for engineering research be high enough to recoup both the loss in purchasing power due to inflation over the past five years and some of the loss of effectiveness due to increased sophistication of experimentation.
12. Recommends that attempts be made to ensure that some small fraction of the expenditures for the large engineering projects be allocated to related research work in Canada.
13. Recommends that universities facilitate industrial leaves and sabbaticals for professors where such leaves foster the technological development of the department concerned.
14. Recommends that provincial governments adopt policies which foster good engineering research in both industry and the universities, and that such policies not restrain the universities from cooperative efforts with industrial companies or government agencies.

## Appendix "40"

Submission from

THE CHEMICAL INSTITUTE OF CANADA

to

THE SENATE SPECIAL COMMITTEE ON SCIENCE POLICY

December, 1975:

The Chemical Institute of Canada (C.I.C.), along with its constituent societies, the Canadian Society for Chemical Engineering (C.S.Ch.E.) and the Canadian Society for Chemical and Biochemical Technology (C.S.C.B.T.), is the national scientific and professional organization of chemists, chemical engineers and chemical and biochemical technologists. Through its Science Policy Committees the Institute provides a means for its members to communicate with and assist appropriate organizations concerning government policies which affect its more than 7,000 members.

This submission outlines, briefly, four major areas of concern to the C.I.C. and its members: (i) industrial research, (ii) research in government laboratories, (iii) government support of university research and (iv) employment opportunities. In the months ahead, members of the Institute will be engaged in detailed examinations of these and other areas in an attempt to outline, in more detail, existing problems and their causes and to make, wherever possible, positive recommendations for improvement.

(i) Industrial Research

Members of the C.I.C. have for years expressed concern over the quality and quantity of research in Canadian industry and have questioned whether it is expanding in the way it should. While the Canadian chemical industry appears to be undergoing expansion at the present time, the

expansion is, for the most part, in production facilities and not in the research and development sector. The Institute plans a detailed study of the situation particularly in regard to reports of research personnel reductions and research lab closures in several Canadian industries. The government's "Make or Buy" policy in which Departments such as Environment Canada, Energy, Mines and Resources, National Defence and National Health and Welfare award R & D contracts to industry and other sectors will also be examined. This study will consider the manner in which these awards are made, in particular, the extent to which peer group evaluation is used. It will examine the "Make or Buy" policy with regard to whether this mode of support of research leads to acceptable scientific results and, in general, it will attempt to assess the impact of the policy on research in industry.

(ii) Research in Government Laboratories

It appears that many established research groups and services in government laboratories are being allowed to run down through attrition and general lack of sufficient funding for research. If it is intended that government laboratories be phased out, with their work transferred to other institutions in order to have more viable laboratories in the private sector in the future, then it is important that the matter be kept under constant review and assessment. At the present time, it is of great concern to some members of the Institute that some research may be contracted out to institutions which are not properly equipped in terms of facilities and manpower to handle the work. Possible inefficiencies of this sort require a thorough examination.

(iii) Government Support of University Research

This continues to be an area of grave concern to chemists and chemical engineers working in universities. The situation in which government funding of scientific research in universities remained essentially constant for six

years, in spite of rapidly increasing costs, has been well documented. The encouraging increase in NRC funds announced in the Spring of 1975 was tempered somewhat by the Federal budget cuts in June of the same year. The NRC program of scholarships and grants-in-aid of University research was cut by \$2.7 million and this, coupled with the termination of all DRB funding in 1975 (with the loss of some \$3.0 million of grant support), has resulted in renewed concern for the future of university research. Further study by the Institute in this area will include an examination of the impact, on basic research in universities, of R & D contracts made to university workers through various Government Departments such as Environment Canada.

(iv) Employment opportunities

Employment opportunities for new Chemistry graduates do not appear good at the present time and are certainly poorer than in the 60's when a fresh graduate could expect several job offers. Although the demand for Chemical Engineers and Technologists seems higher than for Chemists, employment statistics for all three groups need to be examined. A particularly serious situation has developed in regard to Ph.D. chemists where a scarcity of job openings in the academic, government and industrial sectors has resulted in a number of them occupying "temporary" postdoctoral fellowship positions for several years. It seems that highly trained personnel in many areas of endeavour, not just chemistry, are currently being under-utilized and close cooperation between post-secondary educational institution, industry and appropriate government agencies is needed to solve this problem. Canada must find ways to make good use of its well educated citizens.



## Appendix "41"

## THE FUNDING OF SCIENTIFIC RESEARCH AND DEVELOPMENT IN CANADA

Submission from

THE CHEMICAL INSTITUTE OF CANADA

to

THE SENATE SPECIAL COMMITTEE ON SCIENCE POLICY

September 1976

INTRODUCTION

Canada, in common with other developed nations, is largely dependent on science and technology for the maintenance and development of her material standard of living. Indeed, one can go further and justifiably argue that the impact of science and technology extends well beyond the purely material to the quality of life, for it is because of the improvements in productivity wrought by the application of science and technology that we in this country today have the choice open to us of whether to pursue further increases in material well-being or to devote increasing amounts of time and energy in non-material endeavours.

On the negative side, many of the problems which confront us today: resource depletion, environmental deterioration, suboptimal urbanization, and the like have at least some of their roots in misapplication of science and technology and their solution will require additional input and some redirection of science and technology.

However, unlike most other developed nations, Canada has not been sufficiently concerned to see that there has been developed in Canada an adequate fund of scientific and technical knowledge or of scientifically and technically educated people. In essence, we have been satisfied to base the standard of living which we presently enjoy in this country on depleting natural resources and the scientific and technical knowledge and efforts of other people. When we have spent money and effort, it is far from clear that the spending has been done in anything that resembles an optimum fashion.

It is the concern of the members of The Chemical Institute of Canada and its constituent society, the Canadian Society for Chemical Engineering, that recent federal government actions towards the funding of scientific research and development in Canada, far from improving what is an unhealthy situation, will serve only to reduce further the supply of personnel and

the level of available knowledge and jeopardize both the standard of living and quality of life in this country. In sharp contrast to the recommendations made in 1972 by the Senate Special Committee on Science Policy, the financial support for research and development in Canada appears to be declining. The percentage of Canada's GNP spent on scientific R and D (already the lowest of the OECD nations) continues to decrease.

We affirm our previous position<sup>1</sup> in which we endorsed the Lamontagne Committee's proposed shift in priorities toward applied research and development. We also urge the adoption of the Committee's recommendations for the budget for basic research - a significant annual increase which will at the very least compensate for inflation and the sophistication factor. We also feel that much greater attention needs to be directed towards stimulating technologically based innovation in Canada through reduced taxes and other appropriate means. Such actions are essential if the present efforts of our scientific and technical people are not to be wasted and the country faced with technological bankruptcy.

#### RECOMMENDATIONS OF THE LAMONTAGNE COMMITTEE

At the beginning of this decade, national expenditure on research and development in Canada was less than 1.3% of GNP. The data collected in Tables I and II document clearly the very weak position occupied by Canada compared to other developed countries<sup>2,3</sup>. The extent of expenditure in Canada on basic research (Table I) or on overall R & D (Table II) was only 55-65% of that in comparable countries.

The Senate Special Committee on Science Policy, recognizing the importance of science in Canada and the need to support it at an appropriate level, recommended in Volume 2 of its Report published in 1972<sup>4</sup>

"that national expenditure on R & D should reach 2.5% of GNP by 1980, it being understood that the Canadian government's direct contribution to reaching this target will be restricted to the support of worthwhile programs and projects".

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<sup>1</sup>"Chemistry in Canada", November 1974.

<sup>2</sup>Based on information from NRC originating from a Science Council Study. Prepared by B.E. Conway.

<sup>3</sup>Based on O.E.C.D. Survey for the years 1970-73. Prepared by B.E. Conway.

<sup>4</sup>The Report of the Senate Special Committee on Science Policy. Chairman, Maurice Lamontagne, Q.C., pages 421 & 424.

The report further stated:

"In summary, the committee proposes an increase in the magnitude of the overall Canadian R & D effort to place it more in line with those of similar countries. This change should be accompanied by improvements in the redistribution of the R & D effort toward the development end, from performance by government to performance by industry, and this can only be accomplished by instituting an effective framework of decision-making".

#### GOVERNMENT ACTIONS TO DATE

At the midpoint of this decade, the grossly deficient funding total appears to be getting worse, instead of moving towards the figures recommended by the Lamontagne Committee for the target date of 1980.

The data given in Table III show that while federal government expenditures rose by some 35% (in terms of constant 1971-72 dollars) over the period 1971-72 to 1975-76, federal expenditures on R & D (all sciences) rose by only 6% and in the natural sciences actually decreased by 0.3%<sup>5</sup>. This drastic cutback in government support of R & D has been seen in the termination of all D.R.B. funding in 1975 and the virtual freezing of N.R.C. funds for scientific research in the universities over the past six years.

The repeal of the Industrial Research and Development Incentives Act was announced on December 18, 1975, by Treasury Board President, Jean Chrétien. This results in a reduction of approximately 20 million - 30 million dollars per year in government assistance, through tax rebates, to private industry<sup>6</sup>. At the same time, Mr. Chrétien announced that the Program for the Advancement of Industrial Technology funds would be frozen. These funds, amounting to about 26 million dollars per year, have permitted many smaller and medium-sized companies to carry out important research and development projects. The general decrease, over the past four years, in grants provided by the Water Resources Research Support Program is documented in Table IV and provides yet another example of R & D cutbacks<sup>7</sup>.

The decline in federal government support for scientific research is further reflected in the figures of Table V. These data show that while total federal government activity in terms of "man years" increased by 17.2% over the period 1971-72 to 1974-75 and while federal government activities in the human sciences increased by the same magnitude over this period, federal government activities in the natural sciences actually

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<sup>5</sup>"Estimates Series", Information Canada. Catalogue No. BT 31-2.

<sup>6</sup>"The Financial Post", p. 1, January 24, 1976.

<sup>7</sup>Office of Research Subventions, Inland Waters Directorate, Environment Canada. Annual Reports, 1972-1973 to 1975-1976.

decreased<sup>8,9</sup>. These figures would not necessarily be inconsistent with the recommendations of the Lamontagne Committee if government support of industrial and university R & D had increased correspondingly during this period. However, as discussed above, this has clearly not been the case.

It is true that there have been some moves on the part of government to support scientific research. Recently in the Province of Alberta, two new sources of funds for research have been announced. The Oil Sands Environmental Research Project opens up 4 million dollars per year for research on the environment related to the Oil Sands, funded jointly by Ottawa and Alberta. The Alberta Oil Sands Technology and Research Authority has 100 million dollars to spend over five years. Similarly, the federal government's support of pollution abatement research in the pulp and paper industry has been helpful. While such moves are in the direction recommended in Volume 2 of the Lamontagne Committee report, they are rare in Canada today. They represent only a small contribution to the "massive increases" recommended in the components of the total R & D budget for categories other than basic research. Moreover, they provide virtually no increase in the budget for basic research which according to the report "must also contain the sophistication factor representing the rise in the cost of doing a given volume of research".

#### SOME MANIFESTATIONS OF GOVERNMENT ACTIONS

Dr. Roger Gaudry, former Chairman of the Science Council of Canada, has reported that the problems experienced by university research workers result partly from the failure of Federal Grants to come close to matching inflationary pressures during the past five fiscal years<sup>10</sup>. During that period the cost of doing research has increased profoundly because of salary increases, increases in graduate student and postdoctoral stipends, a decrease in the number of scholarships available, and the effects of inflation on the cost of scientific supplies and equipment. As a consequence, in research laboratories in universities, as well as in industries and government institutions, outdated equipment is not being replaced and research groups are decreasing in size as well-qualified, scientifically trained personnel are let go and not replaced. In some cases, particularly in smaller universities, research groups have lost their funding entirely over the last few years, resulting in a loss in research momentum and a concomitant reduction in the research and teaching capabilities of the institutions involved.

The short term effects of the present Government policy are difficult to assess. Distinguished scientists may leave this country in search of better situations and the chances of attracting such people back in the future are remote. Once a research group has been allowed to run down it can be expected to take many years to build it up again considering the long training period required for scientific personnel.

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<sup>8</sup>"Federal Government Activities in the Natural Sciences". Statistics Canada Catalogue No. 13-202.

<sup>9</sup>"Federal Government activities in the Human Sciences". Statistics Canada Catalogue No. 13-205.

<sup>10</sup>Annual Report of the Science Council, 1974-75. See also "Government Scan", Chemistry in Canada, September 1975.



On the other hand, if the present Government policies are pursued, the long term effects are not difficult to assess. Canada is heading to a condition of scientific and technical dependence, the effects of which may be as drastic as those occasioned by the energy imbalance which so rightly concerns us.

TABLE I

EXPENDITURE ON BASIC RESEARCH AS A PERCENTAGE OF GNP\*

	<u>% of GNP</u>	
Netherlands	0.6	
Japan	0.4	
U.S.A.	0.4	Canada % of
France	0.4	--- GNP as a fraction
Germany	0.3	of the average: 55.5%
Belgium	0.3	
U.K.	0.2	
<u>Canada</u>	<u>0.2</u>	

\* See reference 2.

TABLE II

GROSS EXPENDITURE ON RESEARCH AND DEVELOPMENT

AS A PERCENTAGE OF GNP\*

	<u>% of GNP</u>	
U.S.A.	2.5	Canada R & D % of GNP as a fraction of the average: 63.2%
U.K.	2.3	
Germany	2.2	
Netherlands	2.1	
France	1.8	
Japan	1.7	
Belgium	1.5	
<u>Canada</u>	<u>1.3</u>	
Average:	1.9	

\*See reference 3.

TABLE III

An Analysis of Federal Government Expenditures 1971-72  
to 1975-76\*

	<u>Current Dollars</u>		<u>Constant<sup>†</sup>(1971-72) Dollar</u>		
	1971-72 (\$10 <sup>6</sup> )	1975-76 (\$10 <sup>6</sup> )	1971-72 (\$10 <sup>6</sup> )	1975-76 (\$10 <sup>6</sup> )	Percent Change
Total Federal Budget -	14,841	28.242	14,841	19,999	+34.8
Federal Expenditures on:					
Natural Sciences -	833.5	1,174.1	833.5	831.4	- 0.3
Human Sciences -	185.2	354.0	185.2	250.7	+35.4
Total (All Sciences) -	1,018.7	1,528.1	1,018.7	1,082.1	+6.2
-Research & Development	667.0	997.6	667.0	706.4	+5.9
- Related Scientific Activities -	351.7	530.6	351.7	375.7	+6.8

\*Data taken from reference 5.

<sup>†</sup> Deflated using the October 1st (mid fiscal-year) values of the Consumer Price Index.



TABLE IVWater Resources Research Support Program, Inland Waters DirectorateEnvironment Canada\*

Year	No. of Universities	No. of Group or Interdisciplinary Projects	No. of Projects by Individuals	Total of Grants, Current Dollars	Total of Grants in 1972-73 Dollars assuming 6% annual inflation
1972-1973	29	-	89	\$1,413,675	\$1,413,675
1973-1974	24	6	44	\$1,146,660	\$1,077,860
1974-1975	20	8	21	\$1,000,000	\$ 880,000
1975-1976	21	11	26	\$1,000,000	\$ 820,000

\*Data taken from reference 7.

TABLE VFEDERAL GOVERNMENT ACTIVITIES: MAN-YEARS\*

	1971-72	1974-75	Percent Change
Total Federal	286,976	336,262	17.2
Sciences:			
Natural    - R & D	16,749	16,858	+ 0.7
- Total	24,930	24,779	- 0.6
Human      - R & D	1,418	1,629	+14.9
- Total	8,575	10,044	+17.1
Total      - R & D	18,167	18,487	+1.8
- Total	33,505	34,823	+ 3.9

\* Data on Scientific Man-Years only available up to 1974-75 in published form. All figures given are "Full Time Equivalents" 8,9

Appendix "42"

SUBMISSION

TO

SENATE SPECIAL COMMITTEE ON  
SCIENCE POLICY

ON

THE ROLE OF  
CANADIAN  
CONSULTING ENGINEERS  
IN  
CANADA'S FUTURE

THE ROLE OF  
CANADIAN CONSULTING  
ENGINEERS IN  
CANADA'S  
FUTURE

February 26, 1976

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5. Given that we have Clients in Canada and abroad who have access to financing for their projects; we must be concerned about the longer-term availability of the skilled people who will make it possible for us to serve our Clients, and who will manage, operate, and maintain the plants and facilities we produce.
6. With accelerating social change and the growth of public awareness, the values and ethics governing our decisions have been changing in degree if not in kind. We must be concerned about meeting our obligations to Society, to Clients, to the environment, and to our Employees and their families.
7. To do these things we must be concerned about our own profitability, so we can survive, grow, and meet and overcome new challenges.
8. The private sectors of society have not provided moral, economic, or technological leadership adequate to our times. Government has inexorably occupied this vacuum. This has accelerated the pervasive growth of the Government sector, and, as Government has assumed policy leadership, it has attracted to it many of the best and the brightest people. Accordingly, we must be concerned that the pragmatic system of checks and balances, that is essential to the maintenance of a free society, does not break down.

FOREWORD

The Association of Consulting Engineers of Canada has a fram of reference through which it views major issues; though issues may change in importance, our framework of interests does not.

This submission describes our views on our society and times with specific reference to national science policy.

The ACEC Frame of Reference

1. Because we are a part of the service sector, working for others, we must be concerned about the ability of our Clients to obtain the funds they need for capital projects for replacement and expansion.
2. Accordingly, we must be concerned about the ability of Canada and of its various regions to generate and to attract investment.
3. We are a relatively sophisticated sector dependent on our technological and managerial capabilities. We need a world market to allow us to develop to our full potential. Accordingly, we must be concerned about Canada's ability to compete internationally.
4. Because we serve Clients, domestically and internationally, who often want complete packages involving hardware, services, and financing, we must be concerned about the strengths and capabilities of Canadian industry and commerce, and about establishing effective working relationships with them for our mutual benefit.

## INTRODUCTION

The Association of Consulting Engineers of Canada is one voice within the broad services sector. That sector as a whole is a "third force" that serves and bridges among Business, Industry, Government, and Education. Within the services sector ACEC is differentiated by a strong professionalism and an emphasis on technological and managerial capabilities.

### Range of Size and Scope of ACEC Member-firms

Consulting engineering companies range in size from one-person firms to large-scale enterprises. Our members are found in all parts of Canada; despite regional disparities, consulting engineers are one set of poles of attraction for local agglomeration of technological and managerial resources. Despite some common interests, we are engaged in strong and creative competition one with another. Though engineering is our main thrust we have recognized the need to associate with many other kinds of skills, to provide our clients with the more complete capability they need. Accordingly, many of our Member-firms include skills and disciplines ranging far beyond engineering. We have recognized, and adapted to, new needs. This process continues.

### Historical Evolution and Characteristics of ACEC Member-firms

Consulting engineering firms are broadly representative of small-business entrepreneuring. All were founded by people with a sense of the market, and/or some strong technical experience, and an unusual readiness to take risks. This is a typical pattern in consulting with the main requirement being a good measure of self-confidence.

The next stage in the evolution of consulting engineering firms was (and is) the acquisition and development of professional managerial capability, and a gradual broadening of technical scope. The entrepreneurial founder usually lasts one generation, but then the firm must be supplemented by these other talents. This process of evolution is highly developed and elaborated, because many of our Member-firms have been in existence for decades, building, and adapting to new needs.

Thus, ACEC represents a sophisticated resource built upon technological and managerial capabilities, and well-acquainted with risk.

This level of sophistication requires a world market to allow us to develop to our full potential. Accordingly, we are concerned about Canada's ability to compete internationally, and we have taken a leading role in packaging Canadian capabilities for export.

We are reservoirs, developers, and promoters of knowhow. Because our resources are limited, and the challenges are large, we have had to concentrate not only on achieving excellence but on obtaining optimum solutions to the fundamental problems Canada faces. We have had to develop a global approach, to build on our strengths in order to surmount world competition. Accordingly, the pursuit



of excellence is one component of our Credo. This translates into a never-ending effort to push back the frontiers toward higher-level knowhow.

#### A Commitment to Canada

ACEC Member-firms are Canadian in fact. Our roots are in the Canadian experience. Our strengths, which we are marketing to the World, derive directly from Canada's society, history, climate, and topography, which define its unique challenges and needs.

Canada's control of its own destiny rests in part with the ownership of its own resources. The paramount resource today is knowhow. The Canadian tradition has been to surrender equity ownership to foreign firms. The modern analog of that unfortunate process is to surrender ownership and control of knowhow to foreign firms.

Canada's current trade deficit in management and technological services is around \$1 billion a year. Canada imports literally millions of pounds of engineering drawings each year. Canada assigns management of major projects, that include a large component of research and development, to foreign firms. These firms end up with the knowhow and the reputation.

It is not as though Canadian organizations lack competence to manage these very large projects. Our "Capabilities in Exile" are recognized abroad, and have been proven time and again. But as in the arts, recognition at home comes slowly and grudgingly.

There is no project in Canada, present or contemplated, no matter how large or how complex, that could not be managed by

Canadian capability. This may, in many cases, require a consortium of skills. This is the rule rather than the exception on major projects, in Canada and abroad.

The Government of Canada has made a beginning to encourage the expansion of Canadian content in engineering and construction. The same philosophy should apply equally to Canadian content in the conceptualization and the R and D phases of these projects.

Many foreign technological organizations maintain subsidiaries in Canada, often employing many Canadians. On the face of it, this seems to meet, at least in part, the demand for Canadian content; but while the argument should not be taken to its extreme, there is some truth to the allegation that every competent Canadian who works for a non-Canadian enterprise is to an extent working to diminish Canadian Sovereignty. This can only be countered by offering superior challenges and opportunities, in Canada, in Canadian-owned organizations. The members of ACEC are Canadian in this full sense.

One of the important capabilities ACEC members have developed, and are continually strengthening through working on major projects, is Project Management. In the Canadian context, this means the skills and the systems to plan and to manage the development of our own country.

NATIONAL INNOVATION AIMS AND GOALS

One of the more satisfactory definitions of the Aims and Goals of the Federal Government in science policy can be found in one of their own reports; in this case, the introduction by the Hon.

C.M. Drury to the Grasley report on risk capital.....

"...concern for the creation of an environment conducive to the development of an indigenous technological capability in Canada which will contribute to the country's social and economic goals ...to make our country a better place in which to live."

Accordingly, technology has to be seen as part of, and not as distinct from, its complete social, economic, physical and human matrix.

Daniel Bell, in his recent book "The Coming of Post-Industrial Society," gives us some indications of a future predicated on a strong services sector and a particular emphasis on technological and managerial skills. He summarizes its characteristics in this way:

1. The change from a goods-producing to a service economy (the majority of jobs are in services rather than in manufacturing).
2. The preeminence of the professional and technical class (a change not only in where people work, but in the kinds of things they do).
3. The centrality of theoretical knowledge as the source of innovation and of policy formulation for the society. (Knowledge, and its applied derivative...Knowhow, are the ultimate and universal world currency).
4. Future orientation: the planning of technology through technological assessment, and the control of technology.
5. Decision-making based on the rise of a new "intellectual technology." (In other words, the 'management of organized complexity').

" The centrality of theoretical knowledge..." requires us to look at where we have come from technologically in order to appreciate what is happening today. The technology we are all familiar with is the culmination of a process that started with the Industrial Revolution and that blossomed forth in the Victorian era. In other words, we are riding the crest of technology rooted far in our past. It is applied and empirical.

We are now experiencing the rise of totally unforeseen technologies, rooted in theoretical physics and chemistry. These new technologies require new attitudes, and new knowledge. An evident example is laser technology. Other areas, already identified as candidates for Canadian science policy, are: Energy (fusion, solar, hydrogen), Oceans, Space, Transportation, etc. Even the inexpensive micro-circuit calculator is a technological discontinuity that is shaping new man-machine relationships.

Accordingly, we are at the beginnings of a new kind of technical knowledge revolution with unknown implications -except to say that the applications will be manifold and will likely overturn much of our contemporary wisdom.

It is also true that the old and the new will co-exist for many years, and we will adapt the new to achieve the old, and adapt the old to make use of the new. Accordingly, the practitioners of applied knowhow have a particular and vital role to play in this seguing of technologies; and, since innovation and risk go together, a certain sense of adventure will be needed. This is not a quality that can be legislated into existence, though it can be quite effectively discouraged.

Statement 5, 'the management of organized complexity,' taken in the full sense of Daniel Bell's expression, includes the credo



of the systems philosophers. We take a more mundane approach and equate it, for the time being, with the ability to manage very large and very complex projects.

We underscore this point, because to manage one must comprehend, and thus, project management is a capability of great importance to Canada and to its future. It is one of our capabilities.

### The Environmental Dimension

The ethics and values affecting our work and the activities of our clients have been changing rapidly, in tune with changes in the larger society and an accelerated growth of public awareness. We have become custodians and practitioners of multi-disciplinary, social and environmental knowhow, with the practical skills under one roof to measure, evaluate, correlate, interpret, recommend, and implement. Accordingly, we represent a unique characteristic in Canadian technological society.

A significant proportion of civic and industrial capital investment is dedicated to environmental improvement and the upgrading of obsolescent plant and equipment. The late 1960's saw the start of an inexorable process that is still continuing, the shaking out of ineffective plants, business sectors, and managements. The price of past weakness and an inability to change and adapt is now being paid with interest.

### Scope of Private Sector Involvement in National Science Policy and Programs

Engineers have traditionally been arbitrators in making the necessary tradeoffs among costs and benefits; this is the very basis of policy-making.

We have already made mention of our contributions to the design and implementation of environmental policy. Environmental affairs are not only technical in nature; the social dimensions are necessarily a part of each situation. This is where the "Quality of Life" takes on meaning, by bringing together the "How" and the "Why" of a project or a program. This is the proper role of the consulting engineer.

We have helped to bridge the void between public policy and vested interests in Canada, a void that is so obvious when we look at the U.S. scene. The lack of this implicit arbitration function at the time of policy formulation has led directly to the politics of confrontation that blights the U.S. but that are relatively subdued in Canada.

Our pre-eminence in environmental impact has developed directly from public awareness, which made impact assessment a recognized part of site selection, and public participation in site selection has become the rule, rather than the exception.

We conclude that an engineering perspective on the social sciences as well as on technology is useful to Canada because it helps to identify what the issues really are, it helps to formulate better policies, and this all tends to reduce the need for confrontation.

Therefore, social R and D is a priority, and the human sciences, in the broadest sense, should be brought within the scope of the Federal Government's Make or Buy policy.

More important still, communication and consultation are needed between Government and all the components of the private sector (not just with consulting engineers). The private sector must be directly involved in formulating policy, and not isolated to deal solely with gathering of data, or program implementation.

We of the private sector receive contracts from Government for specific tasks. We do "bits and pieces." The scope of most work contracted out by Government is narrow; representing only a fragment of a whole. There are exceptions to this rule, but not enough of them.

As a result of this limited involvement, both the private sector and Canada lose something of value.

We are generally not consulted at the conceptual stage of a project, and the conceptual phase is where the real potential for innovation and economy can be applied to the project. Accordingly, Government should make much more use of our knowledge and expertise when drawing up the terms of reference for projects.

Once the terms of reference are set, Government should not pre-determine the nature of the methodology but should allow the private sector maximum freedom to respond with the "How." When the "How" is not pinned down in advance there is much more room to innovate. This is borne out by the success of the Unsolicited Proposals Program. It shows that the private sector can be creative, innovative, pragmatic, informed, competent, and tuned to national needs.

To summarize, science policy stems from the ways in which science assists the fundamental aims of society. Consulting engineers, and others, act as bridges between science and society, and between different sectors and interests.

We are concerned that policies and programs should be practical, useful, effective, and human.

Unless Government consults, genuinely, and draws on many sources in a pluralistic approach, it will box itself in. The nation will miss out on some important and innovative possibilities. And worst of all, policy becomes the exclusive prerogative of government, with the inevitable and obvious result being confrontation.

Accordingly, national policy creation and implementation should be a process based on extensive contracting out and consultation at all stages.



### Federal Government In-house R and D Activities

The issue of make or buy has been studied at length. The Glassco Commission, the OECD and the Senate Special Committee on Science Policy all came to similar conclusions:

- that the Government of Canada supported a relatively high proportion of R and D compared with other advanced nations.
- but, a much higher proportion of this effort was internal to Government.
- and, the main extramural support in R and D went mainly to the Academic sector.

Accordingly, it was found that Canada's industrial sector was weak in scientific capability, and therefore the Make or Buy policy was constituted to help redress this imbalance by involving industry to a much greater extent in Government research.

The Make or Buy policy is a useful start. However, the proportion of funding allocated to in-house R and D, as compared with that done in industry (overall), shows that the trend to big government is accelerating rather than being reversed.

Excluding cost-shared industrial support programs, the combined in-house expenditures of the five principal science departments of the Federal Government increased from \$134 million in 1966-67 to \$270 million in 1974-75. Over the same period, R and D contracts let out to industry by the same five departments increased marginally, from \$24 million to \$29 million. Accordingly, the ratio between in-house research and research contracted out to industry actually increased over the last decade from 5/1 to 9/1.

It could be argued that much of this expenditure is dedicated to costly facilities that only big government can afford to put in place. Yet the vast majority of government in-house expenditures on R and D (around 80%) are related to salaries. So the Government establishment continues to grow, either by permanent hire, or the use of rental staff.

In the case of rental staff, too often used to get around ceilings placed on absolute size of establishment, the rule should be "Contract out for work, not for people."

Make or Buy is presently limited to "new" programs. It is a good policy, but perhaps it is time to re-examine its basic Mission. The essential mission of Make or Buy is to make science itself part of a re-distributive policy. The aim of that re-distribution is:

- create more industrial innovation in Canada.
- enlarge the industrial proportion of the national science effort.
- develop technology and expertise in the private sectors in support of specific national missions.
- ensure that scientific and technological activities of Government have economic and technological spinoffs.
- contribute to a more even regional distribution of scientific effort.

We would add to that mission the additional qualification:- TO REVERSE THE TREND TOWARD GROWTH IN GOVERNMENT.

Accordingly, we recommend not only broadening the scope of Make or Buy, as discussed elsewhere in our presentation, but also broadening its coverage to gradually include all existing Government scientific activities as well as new programs.

### TECHNOLOGICAL TRANSFER AMONG SECTORS

In terms of numbers, ACEC Member-firms only include perhaps 10% of all the engineers in Canada. Yet that 10% represents a high proportion of the effective technological strength of Canada, because we tend to use engineers as engineers more so than do the other sectors.

There are, however, equivalent high technology forces in industry and in all levels of Government, and the interplay among these people and ourselves is considerable, continuing, and mutually reinforcing. This is true in all fields and disciplines. This interaction is both individual and collective.

Many professionals (as in other career sectors) have several stages to their development. We know that some professionals who have achieved high expertise through many years in Government or industry gravitate to consulting engineering firms, or establish their own practice. This is sometimes done post-retirement, but it equally applies to people who are much younger. This happens often enough to indicate that there is a need for people to do so. The corollary is that consulting engineering firms must provide a useful channel for this kind of technological transfer, or it would not happen. We know that it extends the useful life and scope of an expert, and makes those skills available to a much wider range of potential clients. We also know that each such expert will play a part in the on-the-job training of others; this too is part of the process of ensuring continuity and evolution of knowledge.

Because we serve a range of clients, not confined to any one sector, we sometimes find ourselves carrying out innovation in

an unusual sense, doing what is common in one sector in another sector where it is uncommon or even unknown. This is often the key to major industrial improvements, and it requires a catalytic agent that interacts across different sectors and different industries. In that sense we are very much an innovation bridge.

We carry out technology transfer in still other ways, through acquisition of licenses, through carrying out joint ventures with industrial clients, and through working abroad as a learning curve for additional work in Canada and in export markets.



Increasing Productivity and Motivation: People

Technology is one avenue to increased productivity; but in a service economy, the main avenue is through motivation of the people concerned. This will require a major shift in Government and corporate ethics and values. Certainly, a large measure of our present difficulties as a nation is due to the stresses on individuals imposed by opposing value systems as society changes around us.

Motivation is an individual thing; one cannot motivate others (though one can always demotivate them). People have to motivate themselves. One aspect of motivation is the evidence that people are turned on if they see that positive results can be achieved and that they are economically rewarding as well as socially beneficial. We have helped Canada to make some progress in this direction and it remains one of our principal challenges for the future. It is fundamental to our mission and to our sense of professionalism.

RISK, PROFIT, AND CHALLENGE: A "PEOPLE" ORIENTATION

We are unusual in the extent to which we invest in people. Our only real asset is our people, their knowledge and their experience. They will stay with us and will be motivated only so long as they find we offer a climate of opportunity. They will only be attracted to careers in technology and in the management of scientific and technological businesses if they can see positive indications of our growth, relevance and achievements on a world scale.

We are self-financing for the most part. We finance our growth and development from our own cash flow. While we generally do not have much in the way of physical assets, our capital investment in people and in knowhow is substantial.

While profit is not the end result we seek it is one of the means that allows us to diversify, to present our people with new opportunities for personal growth, and to ensure our continuity through investment in people for the long-term. We must be profitable to survive, to grow, and to do exciting things.

## DEVELOPMENT OF CANADIAN SKILLS

One of our highest national priorities must be the education and development of the people of Canada.

Many of us work with universities and other teaching institutions, on boards, teaching and lecturing, providing in-house training, etc. We give, because we need to get; we are actively involved in developing future cadres. We have to be concerned about the long-term availability of the skilled people who will make it possible for us to serve our clients, and who will be needed in all sectors to sustain Canada's technological and managerial growth. The availability of competent and motivated people is the key limiting factor on our national economic development.

Young people know where the uncertainties in the economy lie, and where the value-system conflicts occur. When the aerospace industry was laying off numerous scientists and engineers it was implausible to argue that students should opt for engineering and scientific careers.

The concept of a planned economy in which needed skills can be defined in advance and caused to happen is just not a reality in a free society. The trend is the other way; people are expressing more and more freedom of choice in selecting a career.

People will pursue particular career paths only if they can see the availability of options, to know that there are desirable alternatives open to them. We also know that more and more people will seek not just one but several careers in their working lifetime. Accordingly, the availability of options in our social and economic fabric becomes paramount to Canada's technological future.

As we described earlier, the consulting engineering sector does represent a bridge among many possible careers. Accordingly, we are one component in the climate that will help to attract young people to technological careers.

We have also proven to be one of the most effective forces for the happy integration of technologically skilled immigrants, because we are tolerant of what people are so long as they fill a need.



## EXPORT ROLE AND MULTIPLIER EFFECTS

The economic future of Canada depends on the ability of Canadians to compete internationally in the export market.

As Canadians, we always have the option open to us of retreating to our traditional role of exporting basic commodities. But if we do this, we will lose any possibility of controlling our own destiny and we will abdicate the concept of a meaningful world role. We will become just one more dependent and developing country.

We have found the Canadian experience to be highly saleable abroad. Our own work has led to export of Canadian services and goods, and to the creation abroad of Canadian-owned subsidiaries-particularly in high technology areas.

Organizations scaled to serve the Canadian market are at a disadvantage internationally where very large multi-national firms operate and where Government-backed ventures are the rule. One answer has been the use of consortia. Consulting Engineers have been among the most successful innovators of this mode of international operation.

Our international role is not confined to export markets, we are also active in promoting foreign capital investment in Canada.

We are also becoming more involved in training people abroad to operate and maintain what we design, manage and build. This has become the most important limiting factor in world development. We see our role in this as crucial and one that will require a greatly expanded effort from us and from Canada.

## PLURALISTIC RESPONSIBILITY IN A FREE SOCIETY

If we learn anything from history it is that a free society needs checks and balances drawn from pluralistic roots. The most dangerous challenge to freedom comes from an elite and centralized power.

ACEC is one component in the pluralistic Canadian society. Canada is a complexity of ethnic, regional, geographic, linguistic and cultural, resource-tied, economic, and professional elements. There is nothing neat in this, because pluralism is not neat. Nor is it particularly efficient. The only thing it has going for it is a remarkable capacity for maintaining freedom.

Government is a creation of society, but it tends to take on a life of its own. This happens where effective checks and balances are lacking.

The answer is two-fold: constraints on the growth and significance of Government, and much stronger initiatives and articulation from the non-government sectors. This will require many more of us, individually and corporately, to act with more courage... to take the risks of building the future without demanding Government guarantees and support at every turn.

Pluralistic responsibility means that each person and each organization is responsible for innovation, dynamism, and growth. Our challenge is to stimulate and encourage people to accept this responsibility.

Government, as we know it around the world and at all levels, has not shown any particular competence in dealing with (or even in anticipating) the major crisis issues. The private

sectors too have lacked foresight. The only sufficient argument for big Government would be the concept of a planned economy, where Government has the capacity and the competence to comprehend and manage the whole. We see no evidence that Government has the wisdom to make this work, or even that such a concept is possible.

Accordingly, we prefer to take our chances with a less perfect but a more spontaneous society in which the initiatives come from many sources and where self-help is more the rule than the exception.

CONTRIBUTIONS TO NATIONAL WEALTH AND QUALITY

It is difficult to draw up a balance-sheet or a cost-benefit statement. If we did so, these would be only some of the main headings:

1. Exports leadership and Multiplier effect.
2. Knowhow repository, and knowhow multiplier effect.
3. Quality of the Environment skills and the Human Sciences.
4. Canadian image abroad, and at home.
5. Career development and options.
6. Ability to plan and manage major programs.
7. Ability to contribute to the realization of future major technology-based programs; e.g. energy, food, oceans, transportation, etc.

If our free society is to survive, then Government policies must sustain and encourage private sector technological and managerial growth. The Make or Buy policy is one positive step. We have tried to suggest some other ideas to accelerate this process.

We have also emphasized that the private sectors must take their own initiatives, and that this, fundamentally, must come from a positive attitude of self-help.

For our own part, as the Association of Consulting Engineers of Canada, we believe that Canada is an innovative land and can become an innovative nation. We believe in our own destiny.



Our Credo is simple:

1. A commitment to Canada.
2. A sense of adventure.
3. The pursuit of excellence.
4. Building on strengths.
5. A World role.













FIRST SESSION—THIRTIETH PARLIAMENT  
1974-76

THE SENATE OF CANADA  
PROCEEDINGS OF THE  
SPECIAL COMMITTEE OF THE SENATE ON  
**SCIENCE POLICY**

The Honourable MAURICE LAMONTAGNE, P.C., *Chairman*

Issue No. 23

WEDNESDAY, SEPTEMBER 8, 1976

**Twenty-third Proceedings on:**

the Study of Canadian Government and  
other expenditures on scientific activities  
and matters related thereto.

(Witnesses and appendices: See Minutes of Proceedings)

THE SPECIAL COMMITTEE OF THE  
SENATE ON SCIENCE POLICY

The Honourable Maurice Lamontagne, P.C., *Chairman*

The Honourable Donald Cameron, *Deputy Chairman*

and

The Honourable Senators:

Asselin	Hastings
Bélisle	Hicks
Bell	Lang
Blois	Manning
Bonnell	Neiman
Bourget	Riel
Buckwold	Robichaud
Carter	Rowe
Giguère	Stanbury
Godfrey	Thompson
Goldenberg	van Roggen
Grosart	Yuzyk
Haig	

27 Members

(Quorum 5)

# Order of Reference

Extract from the First Report of the Special Committee of the Senate on Science Policy, presented on July 10, 1975 and printed as an Appendix to the Minutes of the Proceedings of the Senate of that day, and adopted by the Senate on July 24, 1975:

"The Committee, therefore, recommends that it be authorized to consider and report on Canadian government and other expenditures on scientific activities and matters related thereto;

That the Committee have power to engage the services of such counsel and clerical personnel as may be necessary for the purpose of the inquiry;

That the Committee have power to send for persons, papers and records, to sit during adjournments of the Senate and to report from time to time; and

That the Committee be authorized to print such papers and evidence from day to day as may be ordered by the Committee."

Robert Fortier,  
*Clerk of the Senate.*



# Minutes of Proceedings

Wednesday, September 8, 1976.

(37)

Pursuant to adjournment and notice the Special Committee of the Senate on Science Policy met this day at 9:37 a.m., the Chairman, the Honourable Senator Lamontagne, presiding.

*Present:* The Honourable Senators Bell, Carter, Godfrey, Hicks, Lamontagne, Lang, Stanbury and Yuzyk. (8)

*In attendance:* Mr. Philip J. Pocock, Director of Research and Mr. Jacques W. Ostiguy, Chief of Administration.

The Committee resumed consideration of its Order of Reference dated July 24, 1975 relating to the study of Canadian Government and other expenditures on scientific activities and matters related thereto.

The following witnesses were heard:

From:

*The Medical Research Council:*

Dr. G. Malcolm Brown, Chairman.

*The Association of Canadian Medical Colleges:*

Dr. David Bates, M.D.,  
Chairman, APMC, Committee on Research and Graduate Studies,  
Dean of Medicine,  
Professor of Medicine and Physiology,  
University of British Columbia;

Dr. Douglas Waugh, M.D.,  
Executive Director;

Dr. David Z. Levine, M.D.,  
Associate Professor of Medicine and Physiology,  
University of Ottawa;

Dr. Pierre H. Beaudry, M.D.,  
Associate Professor of Paediatrics and Associate Dean  
for Research and Graduate Studies,  
Faculty of Medicine,  
McGill University.

On Motion by the Honourable Senator Carter, it was *Agreed* that the briefs presented by the Medical Research Council and the Association of Canadian Medical Colleges be printed as appendices to this day's Minutes of Proceedings and Evidence. (*See appendix Nos. "43" and "44"*)

Dr. Brown, Dr. Bates and Dr. Levine each made an introductory statement. The witnesses then answered questions put to them by Members of the Committee.

On Motion by the Honourable Senator Hicks, it was *Agreed* that the full text of Dr. Levine's introductory statement be printed as an appendix to this day's Minutes of Proceedings and Evidence. (*See appendix No. "45"*)

At 12:47 p.m., the Committee adjourned until 2:30 p.m., Wednesday, September 8, 1976.

ATTEST:

Patrick Savoie,

*Clerk of the Committee.*

# The Special Committee of the Senate on Science Policy

## Evidence

Ottawa, Wednesday, September 8, 1976

The Special Committee of the Senate on Science Policy met this day at 9.37 a.m. to consider Canadian government and other expenditures on scientific activities and matters relating thereto.

**Senator Maurice Lamontagne** (*Chairman*) in the Chair.

**The Chairman:** Honourable senators, we have two groups with us this morning who are very directly related to each other. One is at the giving end and the other is more or less at the receiving end. I propose, therefore, that we hear the two opening statements, and then proceed with a general discussion, if this is agreeable to you. I would also ask for a motion for the printing of the briefs from the Medical Research Council and the Association of Canadian Medical Colleges.

**Senator Carter:** I so move.

**Hon. Senators:** Agreed.

**The Chairman:** I now call upon Dr. Brown to address the meeting. I presume that Dr. Brown is well known to all of you, certainly to those of you who were on this committee some years ago. Dr. Brown was very active when he appeared before us on a couple of previous occasions, and I am glad to see him back and looking so well.

Dr. Brown, if you would like to introduce your colleague before you make your opening statement, please do so.

**Dr. G. Malcolm Brown, Chairman, Medical Research Council:** Mr. Chairman and honourable senators, I would like first of all to introduce Dr. Roxburgh, who is Director of Grants and Director of Administration in the Medical Research Council. Next, I want to say how glad we are to have this opportunity to appear before the committee again. We appreciate it very much because it gives us an opportunity to discuss and learn the committee's views on the desired shape and size of Canada's science effort. There is an obvious need, in the light of changed circumstances, for having a discussion at this time, after the interval that has elapsed since your last deliberations.

We are, of course, particularly interested in your views about Canada's activity in medical science, or in health sciences; but we do not forget that your views about other parts of science impinge on us, in the health science field constitute only a sector of the total spectrum, and only a part of the total picture.

As the chairman has mentioned, a brief has been submitted, as requested, and I will be glad to try to answer questions and to expand on any aspects of this statement that you and your colleagues wish. Before making good on that offer, I should like to make a few remarks of a general nature about things that I think it is necessary that we

have some idea about if discussion about health science is to be as meaningful as it should be.

It is health science that we are dealing with this morning, and, as stated in Volume III of your report, Mr. Chairman, research and development is not homogeneous. My first remark follows from this statement.

I want to point out that health research, while a sector of the total research activity in the country, is not just a sector like all the others, and is not a parcel of research like any other parcel of research that might be put together. What is my basis for saying this? It runs roughly as follows. Health research and development is the technical backup for the health care industry, and it is more closely related to that industry than is the case with other large sectors of research. One or two things should be said, perhaps, and we should remind ourselves of one or two things about that industry, and note that the health care industry is very much science-based. It is a social industry, and it is a service industry. I think we are all aware, too, that it is an industry with a high public profile, and an industry from which the public are going to continue to demand a high level of performance. This high level of performance will depend, if it is to continue, on several things. It will depend on the existence of appropriate organizational forms; it will depend on personnel whose training has been adequate in technical and other ways; and it will depend on a continued high input of science and technology, some of which input will originate in Canada, though more of it will be imported.

Here we must recognize that the importation of science and technology can only be accomplished by personnel whose expertise is as sophisticated as the technology to be imported, and, after importation, to be adapted and applied in Canada.

Finally, I would like to remark that a high level of performance by the health care industry will occur only when, in addition to the three points I have mentioned, there is a recognition that both in its curative and its preventive aspects it is people who are being cared for, often people in distress, and that the most effective prevention or cure will be provided only by persons who care. I have mentioned that the health care industry is science-based, and I have already claimed that the linkage between science research and development, and health care, is close. There is a good deal of evidence of this. It is never as close as it should be in an ideal situation, but the gap between the acquisition of new knowledge and its application in a new product, whether that new product is a new medication or a new preventative or diagnostic treatment process, is short.

The reasons for this are in part, organizational, and in part, too, due to public demand for up-to-date health care.

**The Chairman:** Perhaps it is too short on certain occasions.

**Dr. Brown:** It is too short on certain occasions because there has not been enough science in the input, and management decisions, if you like, have outstripped the science. I quite agree with that.

The organizational forms are crucial to the claim that I have made. Some of the ones that are relevant are as follows. The clinicians, the people who actually deliver health care, or the effectors in this whole process are, in quite a proportion, themselves engaged in research, which is a situation comparable to having the works manager and his immediate juniors engaged in the research process themselves. Many clinical investigators not only have their clinical research and clinical responsibilities, but also cross-appointments with the basic departments in the medical schools. There is this tie, and it is a tie that works in the reverse direction, too. Many whose main footing is in the pre-clinical departments have cross-appointments in the clinical departments, so that in Canada, with few exceptions, basic researchers, applied researchers,—the innovators and the deliverers of the final products—are in the same institutions and they are often even in the same field.

I submit that these features lead to a good and quick mixture of innovations arising in three classical ways, and no matter which of these you look at, from user to man, which is high and sometimes too high, from technology pull, or from science push—in each of these three ways, simply because of the arrangement of personnel in the health research and development system, there is quick response. Therefore, in health research and in the health industry there is a great deal of interaction between those who are our grantees and the professionals engaged in the application of new knowledge that is gained.

My third general remark concerns the particular profile of Canada's health research activities. There is always a small amount in industry when we consider performers of research. There are no large national research institutes, as in many other Western countries, and in Soviet Russia. We do have health R&D in federal research institutes. There is an important element of this in Health and Welfare Canada where it is closely associated with the regulatory functions. There is some in the National Research Council laboratories. But in comparison with other countries, we do not have large national research institutions.

The great bulk of health R&D in this country is performed in the country's universities and hospitals. This is a point that distinguishes our situation from that which exists in most other countries. This has to be borne in mind when we consider the university support of health research, because when the government and others are supporting university health research the government is in fact supporting the main performer. There is in the short term no other performer available. So in our case, in supporting university research, the government is not merely making arrangements that there be some health research done in universities and for the good of the university and its teaching function, it is rather supporting the main performer and, if you like, buying, getting, obtaining, the large part of the country's health research from the universities. It must be because it is there that the health researchers are, as things have turned out for us. With exceptions that make up only a very small part of the whole, the people who are to do the health research that

the government decides it wants done are in the universities.

My next background remark is concerned with the nature of MRC-supported research. I should like to note that MRC-supported research is not simply or only a basic research. If one wants to be strict about this and use OECD definitions, we are not supporting any basic research. It is nation oriented research.

Having said that, let us go on to the shorter term. In the work supported by our council there is a mixture of basic research, applied research, and developmental work, right out to the validation of innovations. This is really what clinical trials of new diagnostic methods, of new treatments, are. These are the testing out of new procedures that are already in production, already in use, and they must be validated scientifically and a decision taken about them. The particular mix of the basic and applied in the case of the MRC may merit the attention of this committee. Here I want to mention that there is a division of labour between the Medical Research Council and Health and Welfare Canada. This is a division concerning a combined statement. It was issued some time ago now by the two agencies. The division works well in the community. We are clear about it. In that particular aspect things go well. By and large the department is concerned with the handling of populations, the biology of populations, while the Medical Research Council is concerned with the rest.

Those, Mr. Chairman, are the few background remarks I would like to make.

**The Chairman:** Perhaps you could expand on the handling of population.

**Dr. Brown:** I would refer to the statement concerning the responsibility of the national health research and development program of Health and Welfare Canada:

Under the general definition of Health Care Research support will be considered for projects of national interest involving the systematic inquiry into:

- (a) the biology of human populations;
- (b) the health implications of existing and emerging personal, community and occupational environment, life styles and health related practices;
- (c) the impediments to impossible measures to stimulate adoption of improved life styles and health related practices;
- (e) the need for, process of and effectiveness of personal, community, regional and other health services having national significance.

Perhaps those give the flavour of the eight or nine items.

Those were the few introductory remarks I wanted to make, Mr. Chairman.

**The Chairman:** Thank you Dr. Brown.

Now we will hear from Dr. Bates.

**Dr. David Bates, Dean of Medicine, University of British Columbia:** Thank you, Mr. Chairman. I am here representing the Association of Canadian Medical Colleges, the organization that brings together the medical schools in Canada. I may say that I am a member of the Science Council, and I have followed the deliberations of this committee with the greatest interest. I am also chairman of the Standing Committee on Research of the Association of Canadian Medical Colleges. With me is Dr. Waugh, who is



the executive director of the Association of Canadian Medical Colleges, and next to him is Dr. Levine, associate professor of medicine and physiology at the University of Ottawa. He is also a member of the APMC Committee on Research. Next to him is Dr. Pierre Beaudry, associate physician-in-chief of the Montreal Children's Hospital and associate dean for graduate studies and research in the faculty of medicine at McGill. He is also a member of the APMC Committee on Research. They will be speaking later on specific aspects of our presentation to you.

I have gone back over our written contribution to you and wish to update it. This field of trying to establish priorities and trying to see where one research sector fits into the general operation of the Canadian endeavour is moving very quickly. There are some parts of our brief that I would like to be able to revise. I am going to begin with the brief as a starting point, together with the presentation we made on July 6 to Mr. Lalonde, which your committee also has, and take it forward.

It is clear from presentations before your committee, as I have read them, that research in the whole field of Canadian endeavour has not kept pace with the erosion caused by inflation. Much of our early brief documented this for you. It has been done so many times and in so many sectors that I do not think we need to go back over the numbers here. We pointed out to Mr. Lalonde that in some sectors of endeavour this impact has been particularly severe. We point out, for example, that the Medical Research Council has been forced to greatly limit its expenditures on equipment.

We have tried to find out how much capital equipment exists in Canada for medical research, which is a very hard figure to obtain. However, we believe it is certainly not less than \$64 million. The replacement and servicing budget for that, as businessmen will tell you, ought to be some fraction of the capital investment, whereas the Medical Research Council has had to cut back as a result on its equipment funding, which I believe amounted last year, for instance, to only a quarter of a million dollars. This means that we are unable to keep pace with ordinary replacement. This is one aspect of the inflation effect.

The second one we documented in detail is the erosion of support for the youngest investigators, the people beginning a research career. The impact, I think, has fallen particularly on those two sectors.

Senator Grosart suggested that we had a task to bring to you what we feel the needs really were in terms of numbers, and we quote his comment. We have tried to do this and have suggested that to get on to the platform of medical research we had in about 1972 would take approximately \$8 million next year. I will not go through those statistics or that arithmetic for you, because really my main interest in being before you today is to bring to your attention three and possibly four philosophical points that seemed to me in the last few months to have emerged more clearly than was true at the time we wrote our brief to you.

The first of these is to look at the relationship between work that is basic to medical science, taking Dr. Brown's definition in relation to the direct application to disease. I want to draw the attention of your committee to a paper by Dr. Comroe, published in *Science* in April of this year and entitled "The Scientific Basis for the Support of Biomedical Science." For the first time a distinguished senior investigator, he being Director of the Cardiovascular Research Institute in San Francisco, has looked at undoubted advances in medical science as they apply

directly to patient care and he has gone back to find out on which advances these depended. He has taken 10 clinical advances in heart and lung disease and traced these back through 4,000 scientific papers, mentioning in the case of cardiovascular disease the key discovery of heparin in Canada 40 years ago as a crucial discovery. This paper shows quite conclusively that basic science research, using the word "basic" as it applies to medicine—basic research which would have had no definite clinical target was the major contributor to the clinical advances which are now part of the best practice in these fields.

Dr. Comroe began that study because the Johnson administration in the United States was much influenced by a study done by the Department of Defence and published in 1966, which apparently showed that applied advances, in engineering particularly, were not much related to untargeted basic research. Many of us in the medical field have felt intuitively that that could not be true in the case of medicine. The definitive study of it, I think, is now to hand and it is quite clear that the medical field is heavily dependent on the information base coming from more or less untargeted research.

I will read Dr. Comroe's conclusion:

Our data compel us to conclude

(i) that a generous portion of the nation's biomedical research dollars should be used to identify and then to provide long-term support for creative scientists whose main goal is to learn how living organisms function, without regard to the immediate relation of their research to specific human diseases, and

(ii) that basic research, as we have defined it, pays off in terms of key discoveries almost twice as handsomely as other types of research and development combined.

**Senator Hicks:** Do you think this applies only to the United States?

**Dr. Bates:** No. I wanted to draw this to your attention because this has been a confused argument. I followed the volumes you published on this with the greatest interest and feel that you certainly analyzed this with great care three or four years ago. In my opinion, only now has there been a very careful study of the biomedical field. As I have indicated, it brings us to conclusions somewhat different from those which, apparently, were derived 10 years ago in the field of engineering. So that is my first up-date, and that is a paper published as recently as April. Had I had it when I sent my paper to you, I would have included a note with respect to it.

The second point that I feel unhappy about, particularly talking with individuals who have a great interest in science policy and the consequences of expenditures in different fields, is the fact that some of the benefits of medical research are missed, omitted, in the assessment of benefits as provided by current indicators. The example I like here is the modern treatment of osteoarthritis of the hip by replacement surgery. This involved a major research endeavour, mainly in Britain and in the United States. The surgery itself involves, of course, hospital costs. I am sure that the whole procedure adds to the costs of medical care, so that the research which led to the advance certainly did not lead to an economy as narrowly defined. However, the result is that there are many people over 60 years of age who are now able to continue to be active, whereas previously they would have been confined to a wheelchair and would have suffered many years of



chronic pain and disability. That is an example of medical research in which a lot of research was needed, an example of a costly operation and an example of an advance which does not appear anywhere in the statistics which are available to civil servants when they attempt to define research in terms of benefit. It could probably be shown that some economy had been effected by long-term care, there being some reduction in long-term disability, and so on. However, in general the benefit, the easement, the improvement in the quality of life for large numbers of people over 60 years of age which that particular advance has led to is somehow missed when doing the arithmetic. I wanted to make that point to your committee, because it is a baffling argument to have in terms of where the research expenditure should go in order to maximize benefit. One of the problems is the assessment of the benefit.

Thirdly, I wish to support very strongly the point that Dr. Malcolm Brown just made to you, the importation function in terms of research workers and community health care, and to add a footnote to what he said, all of which I fully support, of course. However, Canada is a large country. I worked for 16 years at McGill as a research investigator, and for five years I have been dean of medicine at the University of British Columbia, which is quite a long way, and it is great to have a major research group in a discipline, let us say heart disease, in Toronto. Of course, Canada should have centres of excellence in major centres of that kind. But, and it is a very important "but", if progress is to be made in Vancouver, we need in Vancouver people who understand recent advances and can distinguish one from another and bring to bear on the community the benefits which ought to be available to that community, and that means research support.

One of the consequences, as found everywhere in reduction in level of support, is that it tends to become more concentrated in the major centres. Indeed, I can see no way that cannot be prevented if quality in general or productivity is to be the main criterion. However, as our brief to the Honourable Mr. Lalonde pointed out, there is a hazard that as you cut back in terms of inflation at least the first areas to suffer are those in a sense that are farthest away. I am not interpreting this, I hope, in a narrow, provincial, nationalistic kind of way, but just pointing out that it is important to medical schools which are some distance from the centre of Canada to keep a good research presence in most of the major disciplines, if you are concerned, as I am concerned, with bringing the benefits of new advances to those communities. I would like to underline Dr. Brown's point here and give it a little bit of a regional cast, not because anyone is discriminated against but because a consequence of policy can easily be a limitation of what is really available a long way away.

**The Chairman:** You will agree, though, that it is probably less difficult to understand and use the discoveries of others than to make discoveries yourself.

**Dr. Bates:** Yes, sir, I do, but Dr. Brown made a very important point in the sense that you have to have the individual who is completely with the temporary technology to be able to import it. I have heard the Minister of State for Science and Technology remark, as many of us have, that the results of technology can be imported, and in terms of tablets or pills, or whatever, the minister is correct; but if you show him a row of medical journals and say, "Which advance here should we bring into the communities in Vancouver?" you immediately see that you need something very much more sophisticated than just

the ability to give a tablet, in order to bring a new kind of understanding into a community setting.

The discipline, perhaps, Mr. Chairman, which best illustrates this is medical genetics, and Dr. Levine will have an example in the medical genetic field in which, where the research team was first class, the application of genetic screening to the population first came about in Canada, and it will always work that way. So there is this relationship.

Lastly, Mr. Chairman, and I have been a little bit longer than I intended, I just wanted to tell the committee that the Association of Medical Colleges is trying to start an inventory of research in the 16 medical schools across the country. We are asking the dean of each medical school to try to identify the research standing of all the disciplines of medicine and surgery in his school. I have the results from eight Canadian medical schools, but not knowing I was appearing before you today I did not set a deadline of September 1. So I have not the remainder in yet.

This will be the first time, I think, that the dean of each medical school has been asked to indicate whether he feels he has a scholarly base in the discipline sufficient for undergraduate teaching and, more particularly, graduate teaching of high quality. It is clear from the data I already have from this survey that in some disciplines and areas—and this will be no surprise to Dr. Brown, I am sure—we have serious deficiencies, and in some general categories of scholarship we do not seem to have first-class research groups anywhere so far. This is a way of looking at the impact of research funding, as it were, from the bottom end, and I think it is a worthwhile endeavour. We will have to judge some months from now if the information we have collected is really helpful in policy making; but I think that it is a worthwhile endeavour for the reason that the agency is not in a very easy position to identify the deficiencies. They certainly can identify the fact that everything the agency is funding is of high quality, is all important, but it is not easy for them to know what the regional situation looks like. In my medical school, of which I am dean, I can identify some areas of strength, and I am acutely aware of some very important areas where we do not have the base for first-class teaching. We have nobody in clinical immunology. We have nobody doing active research in cardiology on the west coast.

It is one thing, as a dean, to see these deficiencies. They are deficiencies the whole medical school would like to remedy. When the faculty gives us an opportunity to recruit, we recruit into areas which assist the development of those needs, obviously, but the restriction of possibility of funding, of development grants, of new Medical Research Council scholarships, obviously does make it harder for us to fill those deficiencies.

Finally, Mr. Chairman, the Association of Medical Colleges is trying to come at the problem another way round, looking at what deans of medical schools identify as regional deficiencies, and we hope that information will be useful to the Medical Research Council, and possibly to yourselves, in seeing what can be identified as gaps in the present context of Canadian research.

I think that is quite enough for my opening comments. Dr. Waugh, Dr. Levine and Dr. Beaudry will be adding some observations of their own when the opportunity arises.

**The Chairman:** Thank you very much. Would you like your colleagues to make their statements now? Do they

have statements or are they only prepared to answer questions?

**Dr. Bates:** Dr. Waugh and Dr. Levine do have brief statements and I should like them to make them now, if that is convenient.

**The Chairman:** Are they long?

**Dr. Bates:** They are very short.

**The Chairman:** Dr. Waugh?

**Dr. Douglas Waugh, Executive Director, Association of Canadian Medical Colleges:** Mr. Chairman, I thought it would be helpful to the committee if I were to tell you what the association is and what it is all about. It has to be one of the lowest profile organizations in Ottawa.

The association was formed in 1943 in response to a federal initiative to accelerate medical education programs to meet wartime needs. It has met annually since then. In 1960-62 it established a secretariat in Ottawa. The purpose of our association is very simple and straight forward and is as set forth in the Letters Patent, which is to promote the advancement of medical education. The members of the association are the 16 medical schools of Canada, whose deans constitute the council of the association or its board of directors.

In the pursuit of its objective, which is the promotion of the advancement of medical education, we are active in four particular areas. One is information and liaison; another is research at both the policy level and the operations research level; the third is in education and the fourth is in the accreditation of medical schools. In the information and liaison role the association is concerned with the linkages between public policy and the collective role of Canada's medical schools in the fulfillment of their social contract, which we perceive to be that of preparing medical graduates of the quality and in the numbers and in the variety that are appropriate to national and regional needs.

This requires us to maintain close and ongoing liaison with government and with other national organizations concerned with health and medical education and medical care.

The principal instrument by which we communicate with our constituency is a bi-monthly publication, *ACMC Forum*. In our research role the association's secretariat develops policy statements and position papers for our executive committee and council, and also conducts research and analyses on the operational aspects of medical education and research programs in the medical schools. It is the basis of this research which has provided much of the data in our brief to this committee and in our brief to the Minister of National Health and Welfare.

The education function of the association is accomplished through the publication of reports and studies and through meetings and workshops with special interest groups, such as, for example, the admissions officers of the medical schools.

In accreditation we work in collaboration with the liaison committee of medical education, which is a U.S.-based organization, and this participates in site visits on each medical school every five years. Although the process of accreditation is voluntary, it is doubtful that any school that failed to gain accreditation could in fact continue to function.

We function with a very small secretariat staff, but with major support from the eight standing committees of the association. One of these is Dean Bates' committee on research and graduate study. This is simply background on what the association is and attempts to do, its structure, and how we go about it.

**Senator Hicks:** Before you finish, Dr. Waugh, would you just elaborate a little on the accreditation procedures? The way you stated it, it almost appeared to me that we had established an accreditation system independent of our American neighbours, but I do not think this is so.

**Dr. Waugh:** No, this is not so. The liaison committee of medical education is a joint group made up of representatives of the Association of American Medical Colleges and the American Medical Association, and it undertakes accreditation surveys of all of the medical schools in North America, including the Canadian schools. The accreditation survey teams consist of five members for Canadian schools. Four of the five members, and usually the chairman and/or the secretary of the survey, are Canadians. We bring one American along simply to keep us honest.

**The Chairman:** We had better not report that to the Committee for an Independent Canada.

**Senator Hicks:** I don't know about that. I am sure some members of that committee would think that this is a matter that requires looking into.

**Senator Stanbury:** And with regard to the accreditation procedures for the American universities, is there a Canadian along?

**Dr. Waugh:** Not on all surveys. There are something like 117 schools in the United States.

**Senator Stanbury:** Who keeps them honest?

**Dr. Waugh:** Where they have a tricky problem, they invite a Canadian. Where there is a particularly delicate problem, with regard to which they think it is important to have outsiders, they ask a Canadian to take part. I myself will be participating in an American survey in December, and have done so in the past.

**Dr. Bates:** Dr. Levine, Mr. Chairman.

**Dr. David Z. Levine, Professor of Medicine and Physiology, University of Ottawa:** Mr. Chairman, the statement I prepared is somewhat longer than what you would call short. I wonder if I could have the opportunity to present it in about ten or twelve minutes, although I am afraid that is longer than you anticipated. Alternatively, I would be grateful if I could have it tabled, sir.

**The Chairman:** I am in the hands of the committee. The trouble is time, because I know that some of my colleagues have quite a number of questions to ask. Could you summarize the main points, and then we would have your presentation printed as an appendix to our proceedings today?

**Dr. Levine:** Thank you very much. I would appreciate that.

Mr. Chairman, my name is David Levine. I am cross-appointed to the department of physiology. My main affiliation is with the department of medicine at the University of Ottawa. I am involved in teaching, administration, and patient care. My main efforts are devoted to



research in kidney disorders, which is also my clinical specialty.

The main arguments I want to make this morning involve some specific examples which I hoped would convey to you the importance of medical research from the point of view of the medical school. With this in mind, I selected four examples which I gathered with the help of several colleagues.

The first example deals with the use of blood products and the application of new knowledge to patient care. Secondly, I review the introduction of an instructional program in computer-assisted training of medical students. Thirdly, I review a story which most of you are familiar with, namely, the Canadian contribution to the development of polio vaccine. Fourthly, I had the help of Dr. Charles Scriver and his colleagues to highlight for you the contributions of the McGill genetics group in moving from basic to the most applied kind of research and back again to basic research in the context of patient care.

In the first example, Dr. R. K. Smiley has outlined in his own words the specific cost benefits of cryoprecipitate, the missing factor in the hereditary bleeding disorder, hemophilia. He outlines the benefits to Canadians and how his contribution was that of instituting investigations in the introduction of this health care technique based on other basic research, which is known to his group. Dr. Smiley also reviews the research and the use of frozen blood in Canada.

The second example involving instructional technology is one in which I was interested, and I have tried to outline how a program of computer-assisted learning for medical students or house staff, or indeed, any other portion of the medical school curriculum, benefits enormously from investigators who have a close proximity to research, insofar as research areas are intimately, if not synonymously, related to what it is that we teach medical students.

I also outline the teaching ethic of medical schools, at least as I understand it, namely, that our job is to teach students medical science and a scientific approach to disease. This flourishes in an environment where research is carried out, where it is active, and where it is of high quality.

The last example, Mr. Chairman, is that provided by the remedial group involving the introduction of genetic advances to patient care.

I find it difficult to précis these comments of Dr. Scriver, which I think complement, dramatically and effectively, points made by Dr. Bates and Dr. Brown. Suffice it to say that Dr. Scriver shows beyond any question that his interest in basic amino-acid transport led to a screening program for such disorders in children, in Montreal, which in turn led to the recognition of vitamin D deficiency, which in turn allowed Dr. Scriver and his colleagues to recommend that regulations governing fluid milk be altered so that more vitamin D is made available.

The other example that Dr. Scriver refers to is, again, the application of basic research to dramatic patient care benefits in the short term. What was thought to be vitamin D deficiency turns out to be a deficiency, or problem, with the handling of iron phosphate, and the McGill group has in fact led the world in the recognition of a disorder which has affected many children. Now, slowly, Americans and other nations are following the example set in this small patient population.

My concluding remarks, Mr. Chairman, include the observation that there is no way in a medical school to separate who does very basic research from who does applied research, and who are the expert clinical teachers from those who deliver patient care. In fact, medical schools throughout the country have faculty members who wear different hats, not only on Tuesday, Wednesday and Thursday, but often simultaneously. Indeed, all of these colleagues who have helped me with this presentation have simultaneous duties in teaching, patient care, and/or applied research and basic research. Therefore, I think there is no way to separate this kind of overlap, and I think it must be true that this kind of unimposed overlap is the strength of our medical school system. It is all dependent on research in the end. Thank you, Mr. Chairman.

**Senator Hicks:** I think, Mr. Chairman, this presentation may have suffered a little bit by being condensed, or the condensation may perhaps have made it a little more difficult for me to understand all the points that Dr. Levine has made. Could we make it available to ourselves somehow? I do not know if it needs to be printed as an appendix.

**The Chairman:** Yes, I think we should have it as an appendix, because there are all kinds of illustrations there which we should examine more closely.

**Senator Hicks:** Yes. They need to be examined a little more carefully. I therefore move that the presentation be printed as an appendix to these proceedings.

**Hon. Senators:** Agreed.

*(For text of statement see Appendices 43, 44, 45 pages 27 to 105)*

**The Chairman:** Thank you very much, gentlemen. Senator Bell will start the questioning.

**Senator Bell:** Thank you, Mr. Chairman. I find it very helpful having Dr. Brown on one side of you and Dr. Bates on the other. I find it difficult to separate the fields that we are into this morning. They are closely associated.

I read the Medical Research Council brief with great interest and found it most absorbing and illuminating. I was also very much interested in what was not in the brief. After reading "Science Marches Back" by Sandra Peredo in *The Canadian*, which presumably various of our members must have seen, I could not find too much in the Medical Research Council's brief that said "help."

**The Chairman:** That is because they have a good lobby.

**Senator Bell:** Maybe it is. I had a feeling that many of the points raised throughout the brief were understated. As a committee we will have to be very swift to pick out the points that are disturbing to the Medical Research Council.

Coming back to the change in status that you have had since your presentation before our committee the last time, I think it would be valuable if you would enlarge upon just what this change in status in the Medical Research Council means to your activities, having found that you have had to absorb much of the funding that came from other government departments before, like the Defence Research Board's grant and the Department of Veterans Affairs, and so on. Your brief states that you take these activities, particularly the Veterans Affairs, but you do not receive extra funding for doing it. I gather you are very close to the bone now. Here you have no possibility of wheedling—

and you should not have to wheedle—extra funds, to go to a minister and say, “This project is terribly important. We have to get on with it. You can spare something in your budget for that.” That door seems to be now closed. Can you enlarge on this change in status?

**Dr. Brown:** I would be glad to. I am reassured, first of all, that I will certainly not be accused of exaggeration. In this connection I should like to point out that the main part of the brief was drafted, written and submitted before some of the year's worst news had reached us.

There is a problem in the area which the honourable senator has mentioned. There has been a transfer of funds in connection with the research formerly supported by the Department of Veterans Affairs. There has not been in connection with the research formerly supported by the Defence Research Board. We think that is unfortunate.

**The Chairman:** What amount was expended by the Defence Research Board?

**Dr. Brown:** Between \$400,000 and \$500,000. We think this country should have a defence medical research program. We would be willing to mount one and operate it as such, provided something similar happens in this context as happened in the DVA-MRC context where a transfer of funds was added to our vote. We think there should be a National Defence Medical Research program, but we cannot isolate it as such with our present funds and with all of the other responsibilities. If we had a lot of funds we would not need a special transfer. We would have enough money to do it. But as you pointed out, we are not in that situation. This has been a problem. The immediate future does not seem to hold the promise of such a transfer. The resulting situation is, to a degree, unfortunate.

**Senator Hicks:** Was the transfer in relation to the DVA-supported research an amount approximately equivalent to what they had been expending?

**Dr. Brown:** Yes, it was just about what they were spending.

**Senator Carter:** On that point, Dr. Brown, did you take over the prosthetics division of Veterans Affairs?

**Dr. Brown:** Mr. Chairman, there is still a prosthetic service in the department. The element of that work taken over by us was that part which was supported by actual grants from the department to researchers in the prosthetics field. The prosthetic service, as a whole, was not transferred. It stays under the administration of the Department of Veterans Affairs.

**Senator Carter:** Are they doing research with new prosthetics and new applications of principles?

**Dr. Brown:** As part of their operation they are continually trying out new prosthetics. There are several research centres in prosthetics in Canada. We support some of them and others support others. There is very significant effort in this field in Canada. We are well in advance.

**Senator Bell:** In paragraph 4 of your brief you say that a sub-objective is “To support research contributing new knowledge in the health sciences”. In view of the very stringent handicap that the Medical Research Council is under with this lack of sufficient funding, if you are backing a team of researchers and they come up with something that is unexpected—for example, if they are looking for sixteen genes they had better not come up with

a seventeenth—you have to sweep that under the rug because you are not in any position to support the development of this unexpected new discovery. To me this is an alarming thing. Do I have cause for alarm, or is that not a valid picture of the situation today?

**Dr. Brown:** There is cause for concern. Some articles are, of course, written to attract attention and they sometimes overstate things. The example that you have come across that if one is looking for sixteen and finds a seventeenth, then do not go on with it, is really a non-example at two levels in terms of the individual guarantee and the funds given to him by us. He has these in hand up to the three years that the grant lasts. He has a very considerable measure of freedom to redirect his research and follow up new leads. If they are more expensive, then he must get more money. He is free to come back at the next competition and ask for money. The second aspect is that twice a year there is an opportunity for a researcher, even if he has a grant already, to come back with a new idea and to try to get additional funds for it. So that the system is more flexible than is perhaps suggested by the two examples that you have quoted. That is not to say that there is not some inflexibility and some degree of inability to respond to good new proposals in the present financial situation. It is a constraint, without any doubt.

**Senator Bell:** Unfortunately, research, particularly in medical areas, is something for which you cannot go to your helpful local banker and say, “We are out of funds. Kindly back us with extra funds.”

In paragraph 6 of the brief, and you dwelt on this yourself in your opening statement this morning, it is stated that health research is carried out largely in the universities and their teaching hospitals and that in-house government health sciences research and industrial research is relatively small, that in other countries, the balance among these three sectors is different. I am not clear on how we differ. Could you explain this?

**Dr. Brown:** Mr. Chairman, in certain countries the amount of health R&D carried on in industry is very large, those countries being the United States, the United Kingdom, Switzerland, and others, whereas the research expenditures of those pharmaceutical firms belonging to the Canadian Pharmaceutical Association was estimated to be only \$27 million in 1975-76. This is very much lower than in other countries as stated as a percentage of health R&D performed by industry.

**The Chairman:** Has this been declining or increasing?

**Dr. Brown:** During the last three or four years, Mr. Chairman, it has been staying steady in dollar terms, not deflated dollars but current dollars.

**The Chairman:** They claim that the change with respect to patents made by the government some years ago is the main cause for this trend. Would you agree with that?

**Dr. Brown:** Mr. Chairman, I will take the position of neither agreeing or disagreeing. I am not in a position to comment on patent law and its ramifications. I am not sure of the validity of this claim, and therefore I honestly cannot give you an answer to your question.

**Senator Carter:** Are there any figures with respect to the total expenditure on medical research in Canada?

**Dr. Brown:** Yes, sir.



**The Chairman:** I believe some of these figures are contained in the brief we received from the Association of Canadian Medical Colleges.

**Dr. Bates:** I would defer to Dr. Brown in this case, because I am sure that he has a better estimate of that than I. I did have an estimate, but it is for 1972-73 and I really do not know how good it is.

**Dr. Brown:** Mr. Chairman, if we take certain main items for 1975-76, we come up with these figures: First, all easily visible extramural research funds for health science research, including items such as MRC, Health and Welfare, the voluntary agencies, certain provincial grants and so on, amount to \$94.5 million. Then, if we look at the amount that the federal government spends intramurally on health R&D, we have another \$18 million. Then we have an incomplete figure, which is not the total industrial expenditure, but the reported expenditures of the members of the Canadian Pharmaceutical Association, of \$27.6 million.

**Senator Stanbury:** Do you have a figure for some of the societies?

**Dr. Brown:** They are included in this global figure.

**Senator Hicks:** In the \$94.5 million?

**Dr. Brown:** In the \$94.5 million.

**Dr. Bates:** Mr. Chairman, I do now have another figure which might be of interest to the senator. The expenditures in Canadian medical schools for 1974-75, to our best estimate, were approximately \$66 million. So the total is \$99 million being spent everywhere, if you like, as indicated by Dr. Brown's figure. In terms of what is being spent in medical schools, it looks like \$66 million from all sources.

**Senator Carter:** When Dr. Brown was before us in 1969, seven years ago, I believe he told us that MRC funds at that time represented approximately 60 per cent of the total expenditure. It has been considerably reduced now.

**The Chairman:** It would decrease in view of the lottery.

**Senator Hicks:** If the total is \$140 million, MRC is contributing, according to table 1 on page 12 of your report, something under \$43 million.

**Dr. Brown:** That is right and it is contributing approximately half of the grant funds.

**The Chairman:** It is also useful to define as exactly as possible what we mean by health research. I understand that there is some money, at least for research in biology, given by NRC, which is very close to being support for health research in a basic way. Would you agree with this?

**Dr. Brown:** Mr. Chairman, into this we have added those NRC grants that are given to members of faculty of health professional schools. We have also added our grants to members of the departments of biology, electrical engineering, or what have you, because they have one or other indicator of the health industry. Beyond that one comes to the area of what is of potential importance to health. Then you notice there is jolly little one can leave out, because the basis of the whole thing is physics, and where do you stop after that?

**Senator Bell:** Is that not included?

**Dr. Brown:** No.

**Dr. Bates:** No.

**Senator Carter:** Do you have any comparative figures on a per capita basis that would compare Canada with other industrialized countries of comparable size and comparable wealth?

**Dr. Brown:** Mr. Chairman, it is commonly known that we are lower on a per capita basis than the United States. I do not have such figures as requested by the honourable senator easily and quickly available this morning. We have found that the major features and inter-country comparisons are terribly slippery devices.

**Senator Carter:** A bit odious.

**Dr. Brown:** The basis on which each country calculates its expenditure is its own particularly chosen basis. In connection with the figures I have just given the committee with respect to R&D expenditures on health in Canada, I have indicated that at least two major items have been left out. Overhead was left out, and we must add another 30 per cent to the grants. The research component of the salaries of the investigators now paid under a different label should really be added into the health R&D item and bring it up. However, in the published figures in Canada as they are looked at by someone in Holland, they will see only these smaller figures and not the money spent under other labels.

**Senator Bell:** Would that be something, for instance, that would involve TRIUMF in British Columbia? That would be a fantastically expensive piece of hardware if you added it in, even though you amortized it. You would not know if the results would be beneficial to health research.

**Dr. Brown:** That is right. The capital account is not included here. It may be in the industrial figures, but the capital account is not in here, either as capital expenditures made each year or on the basis of amortization.

**Dr. Bates:** Could I add a note to the senator's inquiry about international comparisons? Actually, the best table we could devise is table XII of our brief to this committee. I was interested that Dr. Brown took Holland's example. I was in Amsterdam a month ago at a meeting and the head of a Dutch research group asked me, "Why does Canada spend so little on research?" I said, "Well, what are you thinking of?" And he was quoting OECD figures. One of the problems is that, whether we like it or not and regardless of whether the economists of OECD do a good job of trying to equalize these issues, the fact is that, if you travel as a Canadian, perceptive people, particularly in Holland, will ask why it is that Canada as a well developed, advanced country is, according to them, sixth or seventh in the list. So one does have to live with that as a travelling Canadian, and I find it quite difficult to say why that is. I agree that there are many difficulties in getting those numbers, but the fact is that the international community looks at what comes out of OECD, right or wrong, and that perhaps is one of the difficulties we have.

**Senator Bell:** The figures I have which Senator Carter was asking about—and I do agree with Dr. Brown that it is a sticky wicket to get into figures—indicate that Canada spends \$2 per capita, and the United States between \$8 and \$10 and The Netherlands \$4.50 per capita. That is it for what it is worth.

**The Chairman:** Provided that the figures are comparable.

**Senator Bell:** Right, and who knows.

**Senator Hicks:** Obviously, if you say \$2 per capita for Canada you are only including what the Medical Research Council puts out. That accounts for \$2 per capita right there, but you are ignoring all of the other sources which Dr. Brown has already referred to.

**Senator Stanbury:** From my examination of the briefs we will be looking at this afternoon, which is where I will be doing the leading, there is no question about it: everything is a comparison of apples and oranges. It is almost impossible to come up with comparative figures. The American situation includes the industrial expenditures from which they get tremendous commercial benefits from the export of equipment and materials and everything else. So their financial balance sheet for their research and development is a different thing from Canada's. If you are going to have that much more expenditure industrially and developmentally, and so on, you cannot help but show a much bigger figure on expense on R&D.

**The Chairman:** But your figures include the industrial portion, Dr. Brown?

**Dr. Brown:** Mr. Chairman, that portion of it which is within the purview of the PMAC, and that is the greater part of the pharmaceutical component. There is another small component which will not be of equal size—it will not even be as large as the \$27 million—and that is in the electronics industry having to do with bio-engineering items, and so on. So that 27 is too small there. But you are not going to change it by an order, by refinement. The total industrial component is a few percentage points of it.

**Senator Carter:** Mr. Chairman, you will remember that at our earlier meetings in 1969 and 1970 we went to Washington. When we came to examine their research and development we found that they included public works, and even if they had to build a bridge in order to get to a certain station that was all public works and was all included in their research and development. So there is really no comparison on the industrial side between Canada's expenditures and the expenditures of the United States.

**Dr. Waugh:** Mr. Chairman, may I return briefly to a point Senator Bell raised. I refer to the ratio of MRC research support to research support from other sources. If I may refer particularly to the voluntary agencies, the one I know best is the National Cancer Institute, of which I am president. Its annual rate of increased research funding has been going up at about 20 per cent per year. This is based on voluntary contributions collected by the Canadian Cancer Society. What this at least reflects is that the proportion of targetted research support by the voluntary agencies, and virtually all of them support target research rather than more general research as is supported by MRC, indicates that there is a shift in the balance taking place as a result of the relatively lower rates of increase in funding for MRC and the faster rate of fund growth in the voluntary agencies.

**Senator Bell:** Dr. Waugh, could that also mean that the people of Canada, the individuals, are very much concerned about health research and that they are doing this directly, not simply because it is a targetted thing, but

because they are more concerned than the representatives of the people, if you like, apparently are.

**Dr. Waugh:** That is the way it is frequently interpreted, but I think it is more complex than that. If you can scare people by saying, "You might get cancer. Support cancer research. Support heart research. Support muscular dystrophy research," then that has a certain effect. Those are visible diseases which people are frightened about.

If Dr. Brown wanted to invite people to contribute simply to medical research unspecified, I am not so sure he would collect as much.

**Senator Bell:** That is a good point.

How about special programs, Dr. Brown? Who designates these and how are they funded? I am thinking of the work that has been done on the non-medical use of drugs.

**Dr. Brown:** Mr. Chairman, in our present organization the first point for consideration, an idea having to do with the new special project and also the first mechanism for review of those that have been in hand for a little time, is our Priority Selection and Review Committee. They will usually invoke the aid of consultants in the field and arrive at a recommendation. This recommendation goes to the Council itself, the body of 21 members, and Council makes a final decision. So that is the mechanistic, administrative pathway for this sort of process, if that is what you had in mind.

**Dr. Bell:** Yes, it was. Dr. Brown, if we could go back to the MRC brief, on page 6 in clause 15 where you speak about peer assessment taking over, you indicate that you have your funds set out and you have your budget and so on. You have many good programs but you want them all supported. What is the system for preventing scientists, all with worthwhile projects, from fighting for these funds, when your peer assessment group is saying that these are all great procedures?

**Dr. Brown:** Mr. Chairman, the peer assessors, in their various committees, are asked to express their judgment of the merits of the proposal with a number, and at the end of a series of meetings of all these committees, a master list is put together of all applications—400, 600, 800, or whatever it is—that are being considered; numbers are attached, they are put in the order of the numbers, and with one's money in one's hand one goes down the list, beginning at the top, and when the money runs out, that is that.

**Senator Bell:** Is that a satisfactory system? Is there any work to be done on perhaps setting up a better system?

**Dr. Brown:** Well, more money could be used, Mr. Chairman, and there is scarcely any criticism of the system that would not be removed from discussion by a few more million dollars.

**Senator Bell:** In clause 16 it appears that the funds are allocated by Parliament. Is that really how it works? Is this a parliamentary decision or is it a government decision? As a member of part of Parliament, I cannot remember ever having the actual subject put before me.

**Dr. Brown:** The funds come, Mr. Chairman, through a vote, and this is passed on by Parliament.

**Senator Bell:** This would be the minister, in his estimates?



**Dr. Brown:** Yes, exactly. We have two of the votes that the Minister of Health and Welfare must discuss with the appropriate standing committee of the house, along with his departmental votes.

**The Chairman:** I think you will be able, Senator Bell, to see the science budget, including the Medical Research Council's budget, more visibly next year, because the Minister of State for Science and Technology has agreed now to present the so-called science budget display in a separate publication from the main estimates.

**Senator Bell:** So we can see the breakdown?

**The Chairman:** You will have for the first time in Canada, at least, a visible science budget, which will include all these other budgets, which will be taken, really, from the main estimates. You will have that next year.

**Senator Bell:** That would be very helpful for us, because contrary to general belief we do have something to say about money. I have many more questions, and my colleagues have, too, so I will just ask one more and pass, if I may. This ties in with the medical colleges a bit, too. I am referring to paragraph 18 on page 7. There has been a program of full-time researchers in medical colleges. Are these associateships? Anyhow, this is "mission accomplished," I gather. This has been terminated, or some other group is now funding this program—the university itself, perhaps. That sounds like a valuable type of research and researcher to have. What is the situation with regard to that now?

**Dr. Brown:** Mr. Chairman, the situation is that there are no more entries into that program. Naturally, those who have been appointed continue to be supported, and they are supported until the end of their careers, provided they continue to do meritorious research as seen by the council. The program was discontinued because the reasons that led to its initiation in the late 1950s had largely disappeared. At that time the program was meant to be illustrative. There were at that time very few members of faculties in medical schools who were able to devote 75 per cent of their time to research, and that is one of the conditions of the associateship, that there be at least 75 per cent of the associate's time devoted to research.

Council, at the time, was anxious to have demonstrations of the role to be played in medical schools of a limited number of full-time researchers mixed in with the other people, not clustered into an institute but spread across the country in various schools. That illustrative function has now been carried out. There are 70-odd people still being supported in that way, and they will be supported to the end of their careers, given the condition I mentioned. There are now many more than 75 in the medical schools who, as a result of the change in university financing in the years concerned, are devoting the major part of their time to research. The salary of researchers is a problem for the medical schools. That is undoubted. But the first aim of the associateship program was the one I have mentioned. That idea has caught on, obviously, and universities have now appointed these people. We have a number of other schemes whereby we will support investigators for a period of five years, and sometimes longer; but the present policy is not to undertake further lifetime commitments.

**Senator Bell:** I see. Thank you.

**The Chairman:** I have some questions on page 1, where you refer, Dr. Brown, to the ongoing review of programs.

How many reviews and surveys, for instance, during the last two years, have there been? Could you give us an idea? I think it is quite important for the council to review its activities and priorities.

**Dr. Brown:** Absolutely. Mr. Chairman, we are always at it. There is always at least one of these in hand, and sometimes more. At the moment, for example, there are two in hand, and in the last two years the number is of the order of 8 or 10. It might even be 12.

**The Chairman:** Perhaps I could ask what is in effect a kind of preliminary question. I would like to go back to the division of functions of the NRC in its support of biologists and the Medical Research Council. What is really the division of function there? I understand that you help the biologists who are in medical schools and the NRC helps biologists who are in other departments of universities. Is this the division of responsibility?

**Dr. Brown:** That, Mr. Chairman, is the first statement in a description of the division, and after that we come to a few qualifiers. For our part, we say that a project by a faculty member whose place is in the faculty of arts or science or engineering will be considered by us if it is directly related to a health problem. It is not sufficient to claim that it is of potential importance to medical research on health, otherwise we would be taking over the entire molecular biology function, for instance. It must be directly related to a health problem. This is the chief qualifier. We give several hundred thousand dollars in grants to university members outside the health profession schools. The rest of it is the responsibility of the National Research Council. If psychology be a division of biology, you know of the accord among the three councils concerning a division there.

**The Chairman:** On page 4 you say:

The chief function of the Medical Research Council is to "promote, assist and undertake basic, applied and clinical research in the health sciences—".

You really do not undertake research? Or do you?

**Dr. Brown:** There is a fine line here. How does one label the clinical trial which has been organized by the Medical Research Council, using faculty members to do the work? It is only in that sense that we undertake it. We are not supporting it in our own laboratories and we do not have a scientific staff which is doing research in the health sciences.

**The Chairman:** You have labs?

**Dr. Brown:** No. It is not undertaken.

**Senator Hicks:** Was that a quotation?

**Dr. Brown:** It is in the act.

**Senator Hicks:** In fact you have not undertaken in the sense of running a program of your own in the way that the National Research Council does in many areas.

**Dr. Brown:** That is correct.

**The Chairman:** Senator Carter, you had a question on page 4?

**Senator Carter:** My question was on page 5. But while we are on page 4, and I thought Senator Bell might be

asking this, in paragraph 10 you give the composition of your committees. There are not very many ladies on it.

**Senator Bell:** It is the quality that counts, senator.

**Dr. Brown:** Mr. Chairman, about 6 per cent of the medical researchers in this country are ladies.

**Senator Carter:** Well, it is the quality, I guess.

**The Chairman:** Page 5.

**Senator Carter:** Page 6. You receive all of these applications from would-be investigators. You have to screen some of them. The first question I would like to ask is how much detail do you require from them? Do you require a budget for say four or five years for the length of the experiment?

**Dr. Brown:** Mr. Chairman, is the question directed to would-be investigators in the sense of applicants for research training?

**Senator Carter:** Yes.

**Dr. Brown:** So it is the research trainees we are concerned with. The detail asked is roughly this: an official transcript of their academic record; there must be a small number of letters from people who have known them; there must be evidence that they have been accepted for training by the head of some laboratory; and finally there must be a brief statement of the nature of their training and the work they propose to do. Those are the chief components of the application in the national competition.

**Senator Stanbury:** Is a track record of research necessary?

**Dr. Brown:** Not for the men applying for research training. These are the trainees. When one considers applications for grants, then the answer is close to being yes.

**The Chairman:** How close?

**Dr. Brown:** Less than a single percentage point.

**Senator Stanbury:** How do you get into research after training?

**Dr. Brown:** During the training one accumulates a track record, and there are publications. I was taking the question in a different way. I thought we were considering the case of someone who has never had research training, but after a period of professional work decides he wants to do research. He is literally without any track record, not even as a trainee. That is a different case. We have given grants to a few people like that, but they are very small in number.

**Senator Carter:** What about research proposals? This is a person who has a project and requires a grant. What criteria do you use for screening these?

**Dr. Brown:** The important element in the screening is the collective judgment of the committee of peers. They have in front of them the man's track record. A part of each application must be the titles in the journals of his papers during the previous five years. They must all be laid out in detail for the committee to look at and evaluate. They look at his track record. They look at the proposal and make their judgment about the possibility of success. They make their judgment about the capability of the man performing the technical procedures that he claims he is going to undertake. Here again the track record comes in.

**Senator Carter:** Is there an assessment of the institution in which he is going to do the work and the facilities available to him?

**Dr. Brown:** Yes, of the facilities and local colleagues. In a number of situations a given investigator may be considered to have a very good proposal, and the whole thing be a very workable project because of local colleagues to whom he can go for assistance, and so on. The other situation is that the same proposal coming from an investigator who is isolated in this particular sense may fare rather less well. There is this judgment about the success of the proposal in that individual setting, the university setting, and in the hands of that investigator.

**The Chairman:** You say the peer system applies the international standards. Do you have international peers or foreign peers on your committees?

**Dr. Brown:** We have had a few. If we turn it around, Mr. Chairman, the committees are made up of Canadian scientists who have shown they can successfully paddle their canoes in international waters. This is an importation of technology, if you like.

**The Chairman:** So that the committees of peers assess the researcher, his track record, the results of his past research. They also assess the subject matter of the application always in the light of what is going on in the rest of the world?

**Dr. Brown:** Exactly.

**The Chairman:** If something better is being carried out somewhere else, what happens then? He will not receive a grant?

**Dr. Brown:** No.

**The Chairman:** So we are relatively sure that when there is a grant given by MRC, you will expect a research activity that will certainly be as good as any other place in the world, or perhaps better.

**Dr. Brown:** Given the group as a whole, I am quite confident that the standard of Canadian medical research is high. Both the prestige and the standard of MRC operating grants are considerable. I should like to assure the committee, if it is needed, that the level of science support is high.

**Senator Stanbury:** Dr. Brown, do you set priorities as to category of research?

**Dr. Brown:** In a number of cases that is done. The priorities committee had isolated a number of items for special emphasis by council. These were cardiovascular diseases, the heart stroke bit, and cancer. Then there was the medical component of motor vehicle accidents. These were the chief items in the report of the priorities committee last year.

**Senator Carter:** Are these the areas referred to in paragraph 20, page 7, where it is stated:

One of the five main points on which a consensus was reached at that meeting was that council should increase that portion of its funds oriented to areas of national priority and identify funds for target areas.

**Dr. Brown:** That is so, Mr. Chairman, yes.

**Senator Bell:** Who identifies the target areas of national priority?



**The Chairman:** And what are they?

**Dr. Brown:** The identification is again by this priorities committee, using numerous consultants before it arrives at its recommendation, then the decision of council. The priorities recommended last year, that is over and above the support of all good research across the entire spectrum, without respect to subject, were those I mentioned. These items were picked out after lengthy study by the priorities committee, because they met certain criteria. They are problems of national importance and size and because of their economic burden, and so on. They are all perceived as problems by the public.

The three areas I mentioned are also areas in which the state of the science is such and Canadian manpower and resources are such that they can be the profitable subject of research attack at the present time. So it must not only be a health problem; it must be a health problem that is amenable to research over the short and medium term. Those are the bases on which things are picked out by the priorities committee.

**The Chairman:** Could we have a list of these target areas which are being pursued at the present time?

**Dr. Brown:** A good part of the targeting, Mr. Chairman, had to be put aside when we received certain additional information about money and it had to be postponed.

**The Chairman:** I would have thought that the opposite would have happened, that because of budgetary restraint you would have been perhaps more careful to identify target areas and priorities in order to be able to use these restricted funds to greater advantage.

**Dr. Brown:** Yes; I see the point and its logic. It has not been overlooked and not altogether unmet. Whether it has been met satisfactorily, of course, would be a matter of judgment. Already in the cardiovascular areas and the area of cancer research we spend millions of dollars, some millions in each. Council's interest in these areas is known and has been growing. The priorities committee proposed certain special measures in addition to the ordinary grants mechanism. They had previously been identified as areas of special interest. The priorities committee decided they would spend some money in special ways in these areas, and those plans had to be set aside for the time being. So we know and we monitor amounts spent in each of these target areas and make our assessment of the opportunities of spending profitably more money. Then we have to balance this against other demands, such as those of excellent investigators across the whole field. One must ask how high one can go with the rejection rate. This year 15 per cent of the applicants for renewals fell into that group whose applications were judged worthy, but they were not funded. How high can you, without damaging the total science body, carry that figure? This kind of question must be asked.

**The Chairman:** We heard a moment ago that the National Cancer Institute had an increase in its budget of approximately 20 per cent.

**Dr. Brown:** Yes.

**The Chairman:** What would be your reaction to this in terms of funding research projects for cancer? Would you reduce your support for this because of this increase in private funding? To put it in another way, what would you do, for instance, as a result of the creation of this new

lottery in Ontario? If more money for medical research is raised in Ontario, would you withdraw or reduce your support for medical research in Ontario and change your original distribution?

**Dr. Brown:** Could I, Mr. Chairman, just take the NCI example for purposes of an answer and satisfy the lottery problems in a moment? There is a balancing mechanism at work here. Because of the rate of growth of funds for NCI, the rate of growth in grants in support of cancer research, MRC has been lower, without us putting any limit on it, because it is perfectly natural, is it not? There is a pressure for funds, and the grantees will be aware of and sensitive to this and will probe. So that balances out.

The recommendation of the priorities committee was not that MRC increase the number of grants in the ordinary sense for cancer research, but do some special things such as controlled clinical trials of various cancer therapies and put emphasis out at the developmental end of the spectrum in cancer research, right at the point of delivery and assess the treatment. There was some under way and we wanted to increase the amount.

**The Chairman:** But does the National Cancer Institute use the same techniques and the same peer system as you use?

**Dr. Brown:** The President of the NCI could answer that, because Dr. Waugh is also President of the NCI.

**Dr. Waugh:** Yes. The procedure of peer review is generally comparable; it differs in detail. The major difference, I suppose, is in the way the criteria are used on which applications are assessed. Because it is target research, NCI assesses the quality of an application on two bases. One is the merit of the project; second is its relevance to the cancer problem. It is possible for an application to be rejected although very high in merit, but which has very low relevance. If it rates well on both scales it will be funded. The institute has not had the problem in recent years of having meritorious proposals that it was not able to fund.

**Senator Hicks:** When we are referring to the success rate of these applications, may I ask a supplementary question relating to table 4 at page 16 of the brief? It is not clear to me from the context what your dollar award rate means in that table. Is this the percentage of the amount requested that you award, or is it the percentage of the total request that you are able to satisfy?

**Dr. Brown:** Mr. Chairman, it is a percentage of total request. If you wish, I could add two lines to that table: 1975-76 becomes 51 per cent; and 1976-77, post-supplementary vote, becomes 45 per cent.

**Senator Hicks:** There has not been the deterioration in the dollar award rate that I might have expected; it has hovered around the 50 per cent mark since your statistics started in 1968.

**Dr. Brown:** That is true, Mr. Chairman, but I am not sure that the honourable senator would go on or would intend to go on at all to say that the situation has remained unchanged. If one takes a group, takes a model into which there is a limited input each year, as there is in the university faculty model, and keeps cutting off the bottom layers at the rate at which they have been cut off here, then you begin cutting off people of very much higher

quality than you were five or six years ago, and that is the important thing.

**Senator Hicks:** I am glad you made that point.

**Senator Lang:** Would Dr. Brown care to come back to the question of the possibility of a large infusion of research funds from the Province of Ontario and the effect that that might have on MRC? I am particularly concerned about this possibility because I can see it becoming a disjunctive force to medical research in Canada. As contemplated now it would be equal to your total budget. How will MRC react to that situation? Will it have an effect on medical research generally? It would certainly give Dr. Bates a much bigger base to work from in British Columbia. I realize this may be an awkward question, but I think it is a serious one.

**The Chairman:** Would you care to comment?

**Dr. Brown:** Yes, Mr. Chairman, of course I will comment.

**The Chairman:** Perhaps you are like Senator Hicks: against lotteries.

**Dr. Brown:** I would be more in favour of them if I had ever won one. One cannot comment, of course, on policies not yet made, and in so far as I am aware—and I have had some news about this—decisions have not been taken about the methods which will be used to disburse these funds for medical research. For example, as I understand it, there is no compulsion that the funds gained during the fiscal year in this fashion will be disbursed in that fiscal year. It may be possible, then, to spread them out to the greater good of a greater number of people.

There are a number of options open to the province. I am aware, Mr. Chairman, of a strong feeling in Ontario that there be avoided any escape, so to speak, of Ontario medical research from national standards.

**The Chairman:** What do you mean by "national standards"? National standards in reviewing applications?

**Dr. Brown:** Yes. If the need to enter national competitions for grants were totally to be removed for Ontario researchers that would have a mixture of effects, some of them good, some of them bad. People in Ontario are very much aware of this hazard, according to the information I have at the moment. It will be a real perturbation for one province to have medical research funds of this order. It will sharpen up in an unexpected way the regional disparity problem, which is a very real problem.

**The Chairman:** In what way?

**Dr. Brown:** It will make the difference larger, Mr. Chairman, as one compares what goes on in one province with what is going on in another.

**The Chairman:** If you withdraw assistance to Ontario, then you will be able to give more to the others.

**Dr. Brown:** Yes, but, Mr. Chairman, I do not really anticipate that provincial government authorities will suggest that a federal agency need pay no attention to them and that they will not want part of our money even so.

**Senator Hicks:** Surely you will continue to evaluate applications from Ontario on exactly the same basis that you will evaluate applications from other parts of Canada.

**Dr. Brown:** That is absolutely right, Mr. Chairman. but if it is very much easier for an investigator to get operating money through an Ontario granting system, he may not apply to us.

**Senator Hicks:** He may not apply to you, but that is beyond your control.

**Dr. Brown:** That is right. There are hazards in that situation, not only at the bottom of the list but also for the top.

**Senator Hicks:** I am aware of that.

**The Chairman:** Do you think it would be useful to have an annual publication on all the private and public funding of medical research in universities and related institutions? To have that information consolidated in one publication would be useful.

**Dr. Brown:** Mr. Chairman, we have been remiss in a serious way, because we do put out each year just the volume you are describing.

**The Chairman:** Yes?

**Dr. Brown:** And we will see to it that you receive a copy this afternoon and go onto the regular list. This volume gives all of the federal sources and provincial sources and the voluntary sources in so far as we know them. As you know, there are a few important bodies of money which do not publish annual reports, and they do not want their awards to be in the public domain. They are therefore excluded.

**The Chairman:** Is this publication distributed to the media?

**Dr. Brown:** No. We have not published it. It is a detailed volume giving the name of each grantee and where his money comes from and his department and university and so on and so forth. We have not published detailed information of this kind, but to publish the main entries in this book would be something that would not be difficult at all.

**The Chairman:** It would be much more useful, certainly.

**Dr. Brown:** It would be more likely to be read, because the present volume is over an inch thick. If I may suggest, you must have a copy of what is known as the "Brown Book" owing to the colour of its cover.

**Senator Hicks:** To whom is the volume to be distributed then?

**Dr. Brown:** To other parts of government, to the granting agencies and to university people on request.

**The Chairman:** So you will give some thought to having a condensation of this publication?

**Dr. Brown:** Absolutely.

**The Chairman:** For wide distribution.

**Dr. Brown:** I can see that you feel that that would be most useful in the long run and not only now.

**The Chairman:** Yes.

**Dr. Brown:** Absolutely.

**Senator Hicks:** I was going to comment that the publication of such an index of research, with the sources of funds and the recipients and so on, ought not to be restricted to



medical research but should properly cover the whole spectrum. I was about to ask you where you would draw the line for medical research. Perhaps you might answer the latter question. Where do you draw the line in your publication as between medical research and basic scientific research on which a great deal of medical knowledge ultimately depends.

**Dr. Brown:** You are right there. Two of the fences of the field are: one, the source of funds, and it is assumed that a medical agency gives it funds only to medical research; and, two, the administrative base of the researcher, because it is assumed that, for example, if he has been appointed to a medical faculty, he is a medical researcher.

The earlier part of the honourable senator's question can be answered, perhaps, in this way. In the new CISTI organization there is a compilation of research projects such as has been mentioned, and one can get their reports. I believe they cost \$50, which distinctly limits their circulation.

**Senator Hicks:** What is the institution you referred to?

**Dr. Brown:** The Canadian Institute of Scientific and Technological Information. It is the new incarnation of the National Library of Science.

**The Chairman:** I think we should postpone our discussion of the Medical Research Council's brief. We will have to invite you to come back again, I am afraid, Dr. Brown—probably in November.

**Senator Carter:** I just want to confirm the areas of national priority that you gave in answer to Senator Lang's question. Are these the same areas as the ones you regard as the most serious medical research problems in Canada today? I am thinking of cardio-vascular diseases, and a few other areas that you mentioned, which are referred to in your brief as being oriented to areas of national priority.

**Dr. Brown:** Mr. Chairman, the answer to the question is this: They are among the list of items of main national health problems, and they are items about which MRC can do something. That is an important qualifier.

**Senator Carter:** Would you add to the list, then, the ones you mean?

**Dr. Brown:** Well, there are different ways of defining problems.

**Senator Carter:** I am talking about medical research problems. If you had more funds you would undertake more areas, would you? You would include more areas?

**Dr. Brown:** Yes.

**Senator Carter:** What are the ones you are leaving out, that you think should be included?

**Dr. Brown:** If we had unlimited funds?

**Senator Carter:** No.

**Dr. Brown:** More funds?

**Senator Carter:** Yes.

**Dr. Brown:** Well, I have mentioned cardio-vascular disease, which in that context includes heart disease and stroke, and then cancer, and then, pressingly, comes the problem of genetics and the further development of the

research in that area. Then, after that, there is a group of immunological disorders—and this cuts across all the items I have mentioned—and so on. In terms of health problems, one can look at the economic burdens of these different diseases and arrive at a ranking in that fashion, and we do look at that aspect. It is continually in our perspective.

**Senator Carter:** My last question refers to your guidelines for handling work being done on DNA molecules, the engineering of DNA molecules, and the re-designing of the DNA component of viruses and animal cells. This involves ethical and moral considerations as well as scientific ones. What is your approach to this problem?

**Dr. Brown:** Mr. Chairman, the approach has been to divide the work concerned into five or six classes, depending on the degree of risk of spread of the agent concerned outside the laboratory, the degree of risk to the workers in the laboratory, and then, for each of these stages of risk, the conditions that must obtain in the laboratory, and the objective measures there must be in the laboratory if work of that degree is to be carried on.

**Senator Carter:** There was a television program the other night on one of the Ottawa stations in which this type of engineering was condemned completely. It was suggested that we would be creating monsters, and that we cannot know what the results might be. Have you any comments on that?

**Dr. Brown:** Mr. Chairman, my comment would be this, that a sweeping condemnation of this work, I think, is a little beside the mark, and would really be without good foundation. Certain experiments, however, must be looked at in that way. Certain shotgun experiments, which would lead possibly to the recombination of the known component of the gene with any of a group of unknown possible components could lead to the absolutely unpredictable, and our view is that those experiments should, for the time being, be set aside. However, this is shotgun work, and there are irresponsible scientists in this country who are contemplating such work.

**Senator Lang:** May I have the indulgence of the committee for a moment? I have one important question that I would like to direct to Dr. Brown before he concludes. You are familiar with the Petsch report on research in Ontario, are you, Dr. Brown?

**Dr. Brown:** Yes.

**Senator Lang:** I detected in your remarks, and perhaps more strongly in Dr. Bates' remarks, and particularly in his reference to the paper by the doctor in the United States, an attitude of defensiveness with regard to the emphasis on basic research in medical science. If I am reading the Petsch report properly, I think the author is talking about emphasis on type II research as opposed to basic research, and in that regard I would think that his conclusions would seem to vary rather significantly from what I would take to be the view of both of you. I would appreciate any comments you have to make on that.

**Dr. Brown:** Mr. Chairman, it is quite true that in the so-called Petsch report the statement is made that the rate of growth of type II research—they have found it wise to use a new classification—be increase. With this recommendation, I myself, and our Council, would have no quarrel, given the qualifier that also appears in the Petsch report

that the amount available, in absolute terms, for type I research also be increased.

You may remember a table in that report in which the targets are set out, and there is a very significant increase provided for type I research. They say it should not only be supported at its present level, but increased. We, for our part, would agree that type II should be increased, and both type IIA and IIB. Do not talk about it this morning, however, because it is outside our terms of reference as a council. It is a part of health research that has grown slowly, the results from which are badly needed, but it is outside our terms of reference. Health and Welfare Canada is doing an important part of this.

I should like to make a final remark. I am sorry if, for my part, I conveyed the impression that I am defensive about basic research. I am not. I think it constitutes its own adequate defense, and I do not dwell on it. There are many more important policy matters, and policy gets sharper, when one moves to the applied and developmental sector of the problem, and that is the case in association with basic research, and that is why, perhaps, we have spent more time on that.

**Senator Lang:** There is the general recommendation in the Petsch report that health is a national concern, and that, philosophically, at any rate, medical research should all be funded through a national agency, the provinces confining themselves to providing facilities for that research. Would that be in conformity with your views—and yours, too, Dr. Bates?

**Dr. Brown:** Mr. Chairman, I think that they are in a bit of a quandary there and I have communicated these opinions, on invitation, so that it is all in the open, and I am not saying anything behind their back. I think there are unresolved problems in the method of the distribution of responsibility for funding proposed in the Petsch report.

It is proposed for research which is of national interest that there be complete federal funding, but research of national interest is defined as that which receives complete federal funding. This seems to be one of those circles that does not get one anywhere. If you embody that in a health science research unit, as is recommended in the Petsch report, you put that in an organization, then perhaps in a separate building because they speak of the capital cost of these units. You make this distinction between those researchers who are federally funded and those who are supported by various provincial funds. Immediately I ask why. I think this would be to the detriment of research. I have very serious misgivings of the major recommendations of the Petsch report.

**The Chairman:** We have now 35 minutes for questioning the Association of Canadian Medical Colleges. I see that Dean Bates wishes to speak.

**Dr. Bates:** I would like to try to answer that last question. It was partly thrown at me. I think everyone would agree there is certainly a legitimate place for provincial governments in supporting some kinds of medical research because there are some kinds of problems that are the specific concern of some provinces. The very least is asbestos. Its hazard is a concern in two provinces—British Columbia and Quebec. There are many localized occupational hazards. We have one in British Columbia concerning the cutting of Western red cedar. Dr. Malcolm Brown might give that a pretty low priority at the national level in terms of investigating the medical effects of the dust of

the Western red cedar. But the provincial government of British Columbia should have the capability of saying this is a medical problem that it would like to support research in. I can identify that kind of priority.

I do not think, therefore, a completely exclusive position should be taken. It is not easy to structure, but there is a legitimate provincial interest in some medical problems. I think that has to be said.

**The Chairman:** Do you think the provinces should put more emphasis on research in the health care delivery system? This is also quite important.

**Dr. Bates:** I agree with that, Mr. Chairman, except, speaking internationally, it is very hard to see how to do that. I look at the difficulties all countries are having, not excluding Britain and the United States, in getting effective research into the health care delivery system. You may have read about a senator in the United States who put on old clothes and went around the medical-aid circuit in New York to find out actually what happened. I think that is a very good way of finding out. It is pretty drastic, as he found. It is a very difficult thing to get a handle on. I agree with your point. We badly need that sort of information.

**Senator Hicks:** I would like to commence my questioning by complimenting the deans of the medical schools on the brief that they have compiled. In the covering letter signed by Dr. Fraser Mustard, there is this sentence:

I wish to emphasize that our Association is just as concerned with the support of research in non-medical as in medical fields, since it is the totality of scholarly activity in the universities that creates the most favourable milieu for medical research.

Dr. Brown in his commentary acknowledged the correctness of this.

Page 5 of the brief from the deans of medical schools has a paragraph mentioning it. Dr. Bates referred to this very thing himself. It might even be regarded as generous of our medical friends to acknowledge the necessity for an equally generous treatment of research in all areas, as well as in the areas with which they are particularly associated.

From that I might naturally go to the comment that you made about basic research versus applied or practical research. The paper that you have referred to pointed out that basic research was far more effective in its practical results than some people would have had us believe. This differs from evidence that has been put before us, particularly yesterday, by the engineers. Why is this? You are not referring presumably to the accident, let's say, that enabled Dr. Fleming, who was doing basic research, to discover penicillin, but are you referring to some more basic application of research?

**Dr. Bates:** That is a very interesting question. I suppose I could superficially say that it is because the human body is the most complicated engineered system we know of. I could argue it is because of the complexity of this system that the application of basic knowledge becomes more important. That is an incomplete answer. Perhaps it is also somewhat glib but if you look at the specific problem you can see how it really works.

I was interested in the discussion you had on targeting areas of priority. I know Dr. Brown will agree with me that this is an exceedingly difficult problem. As he was talking I was reminded that the head of the Department of Oph-



thalmology at the University of British Columbia told me last week that an increasing problem was blindness occurring in patients with diabetes in early middle life. He is well aware the ophthalmologists are not likely to come up with a solution to that problem. It has to do with the permeability of blood vessels. The final solution to that tragic situation will not come until we know more about the integrity of blood vessels. It is cardio-vascular research, ophthalmological research, and endocrinological research. When you stop targeting priorities, I get worried. It is all of those things, yet everyone recognizes that it is the basic information as to why blood vessels leak that we do not have. It goes right back to the basic information. This is true of so many problems in medical research. I suppose I just come back to the question: Why is it truer in medical research? I guess the only point I can make is that the human body is an incredibly engineered and inter-dependent system.

**Senator Hicks:** That is very interesting. I am glad that you and your colleagues have made that point. Related thereto is your concern, as expressed on page 2 of your brief, that basic research relating to human health and the medical sciences should be placed either within the jurisdiction of universities, or in close juxtaposition to them, in that you would "not favour the establishment of basic research institutes which were disassociated from graduate student training and undergraduate teaching".

Is there really any alternative to what we are doing? There has been some discussion about this. It is mentioned in the MRC brief. I would refer also to page 12 of the MRC brief. On page 1 you will note that the distribution of money from the Medical Research Council has only gone to provinces that have medical schools. So it would appear that medical research is not even being done in hospitals that are divorced from medical schools. Is there is an implication in what you said on page 2 that there is another way to do this? What is the other way? What kind of research institutions exist in other countries?

**Dr. Bates:** Mr. Chairman, we are entering here upon an area of discussion that is continuing, in the sense that the difficulty of maintaining research isolated in the medical field has been emphasized in the last few years. I would refer you to the Rockefeller Institute, which became a university; to the Mayo Clinic, which became a medical school. In terms of the National Institute of Health, which I know better than either of those two, the interrelationship with the university setting is designed to be very close and their activity, particularly in the clinical sciences research centre, is thought of as being, in a sense, complementary to the research being funded in the universities and medical schools.

In Britain there is the National Institute for Medical Research run by the Medical Research Council at Mill Hill. The current director, Dr. Arnold Burgen, incidentally, worked for 15 years at McGill. That is more or less on its own.

**Senator Hicks:** Is it supported by government funds?

**Dr. Bates:** Entirely, yes. They are quite conscious of the fact that they suffer because they are not part of the graduate student setup anywhere. They do, of course, have post-doctoral people working in a very high quality of medical research.

However, the stimulus of the students in the environment seems to be very important here. I would say that the

swing in the last 20 years has certainly been toward a closer integration of research institutes and the teaching function than was true 20 years before that. The relative mix will be argued back and forth, and the more administrative time demanded of university research workers or teaching time, and the less time they get for research, there may be a swing back to the research institute, where the time commitment is fully for research.

**The Chairman:** But, closer to home, how would you assess the medical research being carried on in NRC?

**Dr. Bates:** In the National Research Council? I am not prepared to criticize research being done anywhere. I feel that if they have a good idea and the facilities to pursue it, they should pursue it. I have a fairly liberal view there; I think that to draw fences around is pretty hazardous, particularly if the quality of work is good.

**The Chairman:** But is it good?

**Dr. Bates:** I have no idea. We have an investigator in my university fully funded from the United States, working in the Department of Chemistry. He is working as far as I am concerned in a very relevant medical research area, so I recognize that these things occur.

**Senator Hicks:** But he is still within your university family, or milieu.

**Dr. Bates:** That is right and I recognize the work he is doing.

**Senator Hicks:** You and your colleagues are not very concerned, then, that the essential relationship and involvement of universities and university medical schools with research is going to disappear in this country, or is going to be harmed?

**Dr. Bates:** I think it has been harmed, Mr. Chairman, by the funding difficulty in relation to inflation; I think it has been seriously damaged already. I would like to say that if we are looking at the same pot, then we are already in my opinion at such a low level that to syphon money off to an independent research institute would be a disaster, but it is in that context that it must be viewed if we are referring to competitive dollars.

I would like to leave with you the very important concept that A. N. Whitehead had of a university. It is 50 years old now, but he pointed out that it is the purpose of the university to take students up to the frontiers of knowledge, to combine the knowledge and experience of the old with the enthusiasm and initiative of the young—which is absolutely true of medical schools.

**Senator Hicks:** And other parts of universities, also.

**Dr. Bates:** At one time there were trade schools, but we are not trade schools and we have just this need, to take medical students up to where the frontier of knowledge really is, and that is what a university is all about. So that this has a tremendously important effect in terms of recruiting young research workers. What you get back from having research in the medical school context is, in fact, a pool of young men who are stimulated or challenged by ignorance, or by being taken to the frontier of knowledge, to do something about it.

Everyone I believe is agreed that when research funds are put into the university context, where perhaps the emphasis on research is not as intense as in a research

institute, the side benefit obtained in relation to exposure to students produces tremendous results—hard to assess, but tremendous.

**Senator Hicks:** And a great deal of medical research, of course, depends upon the availability of clinical material and so on, which requires the hospital in juxtaposition to the medical school.

**Dr. Bates:** That is right.

**Senator Hicks:** Are you and your colleagues worried, as some of mine in Nova Scotia are, that medical schools are absorbing costs which ought properly to be paid by the health care delivery services, or is this a problem peculiar only to Nova Scotia? In other words, our professor of medicine is the head of medicine at the chief hospital and performs a great deal of administrative work for that hospital, for which the university pays and does not get repaid.

**Dr. Bates:** I believe there is anxiety about this and not much uniformity throughout Canada. I thought that British Columbia was the only province in which there is not a sharing in teaching hospitals of the faculty salaries with the health service delivery side. Certainly there is a sharing in Manitoba, Alberta, Quebec and Ontario; the Maritimes I do not know very much about.

It is best to have a sharing of that kind which you mention, because it identifies the hospital in its service role very clearly with the university endeavour. I believe most deans would agree that the function of the academic full-time professor in the clinical setting should be seen to be shared for there to be an optimum relationship.

So what the actual trade-off is between the two sides of the fence—health services and education—is extremely complex in any one setting, and I do not know who comes out on top.

**The Chairman:** Before you proceed, I believe there is an omission at the very bottom of page 2 of the brief, where it is stated, "There is very little in-house research in medical sciences in Canada . . ." I am sure you mean government in-house research.

**Dr. Bates:** I believe so, yes.

**The Chairman:** Because you are doing in-house research.

**Dr. Bates:** Yes; that means in-house in the agency.

**The Chairman:** In government.

**Dr. Bates:** In government.

**Senator Hicks:** I can see that, but I see also that it is possible to interpret it in the manner in which the chairman did. The great concern I felt in reading your brief is that which has been stated so often and appears at the bottom of page 4, as follows:

The Association of Canadian Medical Colleges believes that there is good evidence that the public puts a high priority on such research.

And you refer to the damage that the cut-backs in government support of research, including medical research, have already caused, particularly in your very forthright paragraph on page 7 of the brief, and so on. Notwithstanding this, if it is true that the public places a high value on this research, and that government has nevertheless insist-

ed on cut-backs in the face of your estimates of public opinion, and so on, what do we do in order to change this situation?

I suppose I am challenging you a little and saying that you have over-estimated the public concern and have exaggerated the effect of the government cut-backs, and I ask you to elaborate or to underline further, if you can. I mean, thus far have we really lost research teams? Have we not just made people tighten their belts and work a little harder, and so on? Have we really broken up research efforts in Canada by our levelling off of support?

**Dr. Bates:** Mr. Chairman, that is one of the intents of the ACMC questionnaire the medical schools are completing. Each dean is asked to send a note of an investigator on his faculty, anonymous in terms of the name, whose research work has had to be discontinued. I have returns from only eight medical schools so far, and I cannot put this in the general context yet. What I have already indicates that, as I am sure Dr. Brown would agree, many of those no longer fully supported are first class and established research workers. One university that has returned shows, for instance, that two of the three names both have the M.D. and Ph.D. degrees; both of them have given invited talks to international conferences; and they have 30 or 40 publications in professional journals.

This is the answer to Senator Bell, in a way.

**Senator Hicks:** What has happened to these people?

**Dr. Bates:** Their work has had to be discontinued.

**Senator Hicks:** But has it been taken up somewhere else in Canada?

**Dr. Bates:** Well, that is exactly, of course, the point. Has it been taken up? One of the difficulties is that those cases get identified in this kind of article which you passed me, senator, in a way, and the agencies are not in a good position to see that, because they see what they fund, but what they are not funding they do not see, and that is an important dilemma.

Our medical school, three or four years ago, keen to expand in some important areas in which we felt we had little activity, asked for a certain number of Medical Research Council scholars. Recognizing that the Medical Research Council would be unable to fund more than perhaps one or two, we actually asked for ten. However, the quality of what those people would have brought to the medical school had they been fundable was something that I recognized. The agency is somewhat insulated from that deficit and the deans are not, in the sense that the medical schools can see the attempts that have been made to improve areas of work. I would say, therefore, that there are areas of work that ought to be much more fully supported by any yardstick any of us can use. I served on MRC committees of assessment for six years and NIH study sessions for four years, and I just say these are people of quality who should be supported, and who are not being supported. To document it is another matter, and that is what we are just starting to do.

**Senator Hicks:** And that is what you are trying to do?

**Dr. Bates:** That is what we are trying to do.

**Senator Hicks:** You have another reference, which ties in with this, at the bottom of page 8. Your third recommendation is a fair condemnation in saying that:



The dismal record of the Federal Government in securing the future of the nation's biomedical research enterprise, suggests that there must be a serious defect in the mechanisms concerned with the development and implementation of science policy in Canada.

You then go on to suggest that this might be remedied by this committee's suggesting or proposing that the Science Council be given the responsibility of reporting on the adequacy of science research funding.

**The Chairman:** May I interrupt for a moment, Senator Hicks? I know that Dr. Levine wants to comment on this before you go to these recommendations.

**Senator Hicks:** This is not really changing the basis of it.

**Dr. Bates:** I can answer that briefly, Mr. Chairman, by saying that recommendation 3 has already been implemented.

**The Chairman:** In relation to the point you were raising before, I am confused with respect to the figures on top of page 4, where it says, "Table X indicates that there was a reduction of research money from all sources between 1973 and 1975." Whereas in Table X I see that in 1973-74 the amount of money from all sources was \$61.6 million, while for 1974-75 it was \$66.7 million. So there was actually an increase.

**Dr. Bates:** I am glad you brought that up, Mr. Chairman. We had great difficulty getting these figures complete. The right answer is the new Table X which you have, and it does show a reduction of research money in seven medical schools. The text became confused because of an original Table X in which there appeared to be a reduction. We have had one person working at these numbers. Table X had two forms. I am sure the one you have is our best estimate, which does not show a reduction, and you are quite right to point that out.

**Senator Hicks:** Even so, if you take the inflationary factor into account for one year it is almost a reduction when \$66 million replaces \$61 million.

**The Chairman:** I simply wanted to try to reconcile the text and the table. Before you proceed, Senator Hicks, would Dr. Levine care to make his comments.

**Dr. Levine:** Thank you, Mr. Chairman. The honourable senator asked about the damage that may have been caused by the funding cutbacks. One source of damage is erosion of the morale and enthusiasm of the young people, people who are now medical students. We seem to detect a very serious falling off of interest there. I speak now from the perspective of the University of Ottawa, but my colleagues across the country have also had this anxiety of young people communicated to them. We think this should stop, sir.

**Senator Hicks:** That is a point worth making, and I am glad it was made.

**Dr. Bates:** May I come back to the question concerning recommendation number 3. The Science Council, under the leadership of Dr. Claude Fortier, who has appeared before your committee, has brought into being the task force which will in fact implement this recommendation 3. So it is sort of a *mise en marche*, in a sense.

**Senator Hicks:** I was going to go on to say that I wondered whether the Science Council's pointing this out

to government will be effective enough? After all, the Science Council is an agency of government and there is always a certain hesitancy in putting forth arguments like this forcibly to government when they know government ministers do not want to hear those arguments. I would urge you and your colleagues to think of some other ways by which these facts could be brought clearly before the government, and this probably involves convincing the people, generally, to whom the government does have to pay attention at least periodically.

**Dr. Bates:** I would welcome any guidance on that, senator. I have real difficulty with it.

**Senator Hicks:** I wonder whether this is good enough. That is the point I was making.

**Dr. Bates:** So do I.

**Senator Godfrey:** The Canadians for Health Research, who will appear before us, are one example of an attempt to do this.

**Senator Hicks:** That is right.

**Dr. Bates:** If I could comment here, this is an interesting difference between Canada and, for example, the United States, where the peculiar system of funding means that each year, essentially, the National Institute of Health has to defend almost line by line its expenditures before a Senate committee, which is almost a public arena. When you asked where the leadership comes from in the United States for their major efforts in bio-medical research, the answer would have to be from two or three senators on the record. There were some very noisy members of the public in the background. I accept that, but in fact it was the senators who were drawing out NIH, saying, "Are you sure that is enough?" and so on. If you look back to see who seem to have been the dominant people representing the public, I do not see that there was a huge public campaign through the newspapers, or through magazine articles like this, as the genesis of it. It seems to have been institutions like NIH and some senators who seem to have pinpointed it.

**Senator Hicks:** All right. Aside from the arguments that have been put forward about the damage to research and so on, I should like to comment on another statement in your brief in which you say that when you break up a research team or discontinue a research project it takes years to put it back together again. I suggest that is a little bit exaggerated, too.

**Dr. Bates:** It is hard to know quite how to meet that argument, because in some instances it is exaggerated, of course, but in others it is not. We have had to let go a technician with fifteen years' training in research procedure, and that is not easy to reassemble at short notice.

**Senator Hicks:** I am being a bit of a devil's advocate, as you have no doubt discerned.

**Dr. Bates:** But the magnitude of it, which is what you are concerned with, is the point. How big is it? One can produce the anecdotal story, but it is not totally convincing because you are not concerned with one individual or one team. The real question is whether it involves a significant group of people. That is hard to answer, I find. At the present stage I think the major teams in Canada—and Dr. Brown may want to add a note to this—have been kept together to this point. What has suffered has been the

burgeoning, more peripheral and perhaps less well established, endeavours.

**Senator Hicks:** Yes, and the young people to whom Senator Godfrey referred.

**Dr. Bates:** I think that is pretty serious in the long term. It is serious and not just the sort of thing you can brush aside.

I hope we never get to the point when the major, internationally established centers of excellence are disappearing in Canada. I would not pretend we have reached that point yet. But magnitude is very hard to measure. I am sure there have been a few examples of that in Canada, but relatively few.

**Senator Stanbury:** Dr. Bates, I have a rather broad question, which is probably a serious question for us as a country. We are informed this morning, through the news media, that Canada spends the highest amount per capita in the world on education. Although I have not been able to obtain the figures of total expenditures on health care—that is, the delivery system and the research and the whole health care system, hospitalization and so on—I am reasonably sure that we are among the highest in our expenditures per capita for health care. It seems to me that the question is whether our doctors, teachers, et cetera, are taking too much of our economic system personally to allow us to put our priorities in the right place, and balance the use of our money in research and in education in the way you would like to see it balanced in accordance with your presentation this morning. If we are spending the most in the world on health care and the most in the world on education, then there is something wrong with the distribution of that money and the question is, "Who is using more than he should be using in the two systems?"

**Dr. Bates:** you are in both systems and I should like to hear your comments.

**The Chairman:** But he is not a practitioner.

**Dr. Bates:** No, and I am not an economist, which is more to the point. Yes, I would like to say a word. You will find in Table 11 in our brief some numbers on health care expenditures per capita in Canada. It comes out to somewhere about \$105 a head. Health research comes out to somewhere around two and a bit, depending on how you add it up.

I think there are two issues here that are important. The first is the percentage of the gross national product that countries spend on their health care. I take my information here from the current issue of the *Encyclopaedia Britannica*, which has a very good review of national expenditures on health care. We do not spend as much as Denmark, for example. Denmark is spending a higher percentage of its gross national product on health care than Canada is. On the other hand, we are spending much more than Britain, and that is one of the problems in Britain. So we come out, not at the top of that table and not at the bottom. We are not at the top in terms of health research.

Matching those two columns of research and health care is rather a difficult enterprise, and I know that it has been said in front of you, or suggested, by a number of people that perhaps there should be a matching. Whether it should be a precise matching or a general matching is hard to say. I think there is a disproportion in Canada between the two sides, between expenditure on care and expenditure on research. It is not really for me to give any view as to

whether these, or the educational dollar, are appropriate. It depends on your image of what Canada should be striving to become, and before you and I can answer whether we would put more in one or less in the other, we have to sit down and find out what we would like Canada to be 20 years from now—what kind of a country. If we found that we had a general agreement on how we think the country ought to develop in some senses, then we would not have too much difficulty in getting the objectives for some of these boxes correct.

I find this a very difficult argument, because it is not an abstract argument; it is really an argument that depends on your view, in contrast to my view, and one of the points that is not in our brief that I would like to make very clear is that the limitation of opportunity for young Canadians in health research, to which our brief refers, seems to say something about the government's appreciation of the future way that Canada should develop.

When I argue this issue with very senior government people, we finally get to the point when I have a view of Canada they do not seem to share, and one ends up saying, "Well, I just feel that young Canadians with initiative, trained to go into research, and so on, should be given an opportunity to make a world contribution. If that is being prevented, and if thinking is too limited, then one just comes down to a different view of what this country is all about," and there the argument ends.

I have had that argument many times, because I really think that that is where the priority setting has to be.

**Senator Stanbury:** Do you not feel that part of the pressure for the levelling-off of research development money has come from the escalation and the cost of the delivery system?

**Dr. Bates:** Yes, I am sure that is right. This is a problem that every country, except the Eastern European block and conceivably China, is grappling with. I have no specific solution.

**The Chairman:** You say in your brief that you are doing research in medical colleges on the delivery systems. What kind of research is that? Are you devoting a lot of effort to this area?

**Dr. Bates:** I think all medical schools have some presence in this area. In some schools it is strong, and you and I probably know the four or five schools that have been pioneering in Canada in this area. The research resource base in this area is very weak. In other words, in terms of need the people really qualified to do this research in Canada are very few and far between. I believe a special training program to encourage those things is badly needed, but you cannot funnel money into research in an area if you have not got the base of skilled people to do it, and we do not have that base yet.

**The Chairman:** But you admit that in terms of total expenditure this should be a very high priority in order to make our health delivery systems more efficient.

**Dr. Bates:** Yes. I think it is a healthy tradition, Mr. Chairman, that there should be a self-examination type of research—and that is what it is—on the system. I have been disappointed that not many foundations in Canada have been playing some of the roles which have been played elsewhere in this field. For instance, the King Edward Fund in Britain has been the most useful scientific critic of the health service. They have devoted all their



efforts to simple things, such as what actually happens when somebody goes to an out-patient's department, and so on, and they have done a lot of work—distinguished work—in that area as a separate foundation. In the United States the same kind of thing is coming from their much bigger private foundations. I had hoped that in Canada some private foundation would be started to do the same kind of examination which is difficult for the government to do in itself, I think.

Looking at the record, I think that what we should try to get into this act is some kind of foundation which would be better placed to do this kind of thing.

**Senator Hicks:** Would you not also agree, Dr. Bates, that while it is important to be self-critical, this is the kind of inquiry that cannot be done by medical personnel alone, and that they need the cooperation of economists and social scientists, and so on.

**Dr. Bates:** How true that is. I am sure you are absolutely right in that. But the Chairman was asking me why, and what can I say to him except to enumerate all the difficulties that the Auditor General has?

**The Chairman:** I was asking because you said you were doing that kind of research.

**Senator Godfrey:** Earlier you stressed the importance of having research done across the country, and not in just certain areas. I notice that at page 13 of the Medical Research Council's brief they say:

One of the major efforts of the Medical Research Council has been the encouragement of intensive research, often interdisciplinary in nature, on the part of a group of investigators interested in collaborative research. The first of these so-called MRC Groups was established at l'Université de Montréal in 1967. In establishing a Group, MRC undertakes to provide full funding for the operation of the research program so that there will be no need to seek additional funds elsewhere, and if necessary, salary support for the investigators themselves as well as their trainees and assistants.

Then I turn over the page and I look at the groups that have been established, and I see that there are five groups in Quebec, two in Ontario, two in Alberta, one in Manitoba and none in British Columbia.

**Senator Hicks:** And none in the Atlantic provinces.

**Senator Godfrey:** Yes, but I thought you could take care of that. I was very curious about this. What would be the reason why, when the Medical Research Council are prepared to take up all of the funding in these places except for the physical facilities, there is not one in British Columbia.

**The Chairman:** Because excellence is concentrated in Quebec.

**Senator Godfrey:** I was asking Dr. Bates that question, not the chairman. Dr. Bates may agree with the chairman, but we would like to have no prompting.

**Dr. Bates:** Of course, I agreed with the chairman when I lived there. That is easy for me.

I think there are two aspects here. We do have a serious problem with regard to lack of physical facilities, first, in British Columbia. This is something we are desperately

trying to rectify in the clinical part of the medical school. That, I think, historically, is an important aspect.

Secondly, there has to be a base from which that kind of development can occur, and the groups you have mentioned, some of which I know about, were made on a pre-existing base, or in a new medical school, which certainly has a good opportunity to bring in a complete cadre of people, which my medical school does not.

I do not think anyone should be paranoid about that. It is an act of combined circumstances, and I expect it to be rectified. In other words, I am looking to developments which will change that table five years from now, but I think that is the reason for it at the present time.

**The Chairman:** I am sure, Dr. Bates, that you know Dr. G. W. Stanley, who is Associate Dean of the Faculty of Medicine at the University of Toronto.

**Dr. Bates:** Yes.

**The Chairman:** Are you aware of the paper he presented in 1976, entitled "The Jericho Inheritance", in which he is highly critical of the teaching of medicine in Canada, and the great distorting influence that basic research has had on clinical work? Are you aware of this?

**Dr. Bates:** Yes. I do not have it with me.

**The Chairman:** I have it with me, but I just wanted to know if you were aware of it, and how you were appraising his contributions.

**Dr. Bates:** It is very hard to react to that. There are points of truth in it, and I will give you, if I may, an illustration of the truth, which I think we all admit. In discussion of how much the very detailed basic medical science ought to be part of medical education, a professor of physiology from Oslo remarked that any time that he came across an airline which trained its pilots by giving them at the beginning a six-month course on the molecular composition of the rubber tires of the aircraft, he would take a train. What he meant by that was that some medical emphasis has been unquestionably over-detailed in some exciting areas of scientific discovery. To that extent I agree that there is a risk. In the degree of generalities, I do not agree with the article from the point of view of the more liberal approach to the educational process. I think his points of criticism have some validity, but the overall point he is making is somewhat out of proportion, unless in the rapidly advancing field—and this is certainly one—there really cannot be any excuse for teaching the student the practice of 10 or 15 years ago. In other words, there is a real need that he understands the language of modern genetics—which I do not understand because I think genetics was covered by one lecture when I was at medical school; it may have been two.

**The Chairman:** He says here:

Huge amounts of money have been poured into biomedical research, without really addressing the question whether this route alone would lead to better health care for the people who need it. Medical schools became successfully the locus of virtually the entire medical research capability of Canada. Our neighbours in the United States exaggerated this process to the point of absolute dependence of medical schools on the federal research dollar . . .

And he goes on like that.

**Dr. Bates:** Let me just take what you have read. It is true the dependence of medical schools in the United States on research funding was a real hazard and one which, by and large, we have managed to avoid in Canada. We certainly have avoided most of its ill effects. I think it was certainly wise to do that. The objective of spending money in basic medical research is the long-term improvement of health care. It cannot be interpreted in the short term, in which he is confusing the issue there. In other words, if you only look at a very narrow perspective can you really take the sentence that you read to me as true? In the longer term there is no question but that the improvement of health care, if we are talking about the illustration that I gave, the middle aged people with diabetes going blind—and I take it the prevention of blindness is something that would have a very high priority—that kind of thing needs the basic research investment that he is criticizing. There is some truth in what is being said, but it seems to me to be out of proportion.

**The Chairman:** I am sure it may be of some assistance to the committee to have these few quotations. He says:

The past 60 years or so concentrated upon attempts of translating and making science relevant to the clinic. It led to the extension of the ivory tower from the university into the clinical setting. The creation of the full-time clinical faculty in turn led to a detachment from the patient, to the point where the best possible care was delivered by university medical centres, often at the expense of humanism.

These are pretty sharp criticisms.

**Dr. Bates:** Yes. Again there is truth. I grew up in a teaching hospital which prided itself on its divorce from the medical problems 100 yards from its doors. I can detect the truth of what he is saying. Having said that, I do not think the remedy is to say all of that has been a waste. The remedy is to build on the shoulders of that endeavour, and add the dimension of immediate concern for the community, and so on. Each medical step is really standing on the shoulders of the one before. If we have gone through an era of too much emphasis on research, which I personally doubt, then let's build on that and not destroy it in order to do something else.

**The Chairman:** My question is: To what extent are the medical colleges looking at themselves in the light of this criticism and trying, if need be, to change their traditions? Has there been a study of this kind in Canada? You studied the government funding operation and system, and criticize it. To what extent have the medical colleges looked at themselves?

**Dr. Bates:** I can answer that perhaps by saying there is a tremendous amount of questioning, of study, of analysis, in the medical schools in Canada, particularly one in relation to the other. We meet together three or four times a year and try to see whether new things being tried in one medical school, like McMaster or Dalhousie, would be helpful in another setting, what has been learned and the orientation of the medical school.

As a matter of fact, the helpful thing is the accreditation process, which you asked about earlier, because as faculty members spend a week at another medical school they find there is very valuable reorientation, or emphasis on new things, for the students, and they come back to their own campus and say, "That is something we ought to do".

Within the limitations of space, being a very large country, there is a very good flow of ideas across Canada. By and large, I think the self-critical aspect is pretty strongly developed; not perhaps too much in the open, but it is very much there.

**Senator Hicks:** In our medical school every department is evaluated at intervals not exceeding five years. Every evaluating team includes an outside person from another university or from the profession outside. I should think a great many schools do this.

**The Chairman:** I have one final comment and I know that Dr. Levine, at least, wants to make a final comment. We may go on for another five minutes. I refer to your brief at page 9, where you suggest:

—the Science Council should be given the responsibility of reporting regularly to Government on the adequacy of science research funding in all fields in Canada.

I am sure it is within the existing powers and responsibility of the Science Council to do so. I do not think we should recommend this, but it should perhaps be your responsibility to go to the Science Council and force them to do it.

**Senator Hicks:** He has already told us that this has been done.

**Dr. Bates:** That has been done. Dr. Fortier has set up a task force on an ongoing basis, approved at the last meeting, for precisely this purpose.

**Senator Hicks:** This was the recommendation that I questioned the efficacy or the efficiency of.

**The Chairman:** It was that curious hidden committee.

**Dr. Beaudry:** Mr. Chairman, to address myself to the question you were posing a minute ago, to what extent medical schools look upon themselves and do not get involved in the community, I think this might have been an image prevalent a number of years ago, but I do not think it reflects the fact today in Canada. We have examples in my own province, Quebec, in this major effort of government to distribute care in the community in a new format. While attempts have been made up to now with government agencies primarily, there has been an involvement in medical schools, and that involvement is increasing, both on the demand of government and interest in medical schools because it is of primary educational value for the students and primary importance to the patient. This is where the resources, background information, and the variety of expertise necessary to provide that kind of investigation can be found. I think we are seeing more and more of that happening. Research involves more than cellular evaluation in the school. The same disciplines that apply to cellular evaluation must apply to the distribution of care.

If I may, I will comment on your comments, senator, as to what proportion is right. Obviously, part of the answer to the increasing cost of distribution of care is better methods of distribution of care, and that's R&D.

**Dr. Waugh:** I would like to add a comment, Mr. Chairman, to your reference to Dr. Steiner's article, which may be a little background of some interest. Dr. Steiner became Associate Dean of Medicine at the University of Toronto after a long and most distinguished career in fundamental research, to which I am sure Dr. Brown would attest. The

class of 1969 at the University of Toronto named Dr. Steiner as the outstanding teacher with whom they had come in contact in their entire undergraduate careers. In his own case, basic research certainly improved the quality of education, as perceived by his students.

**Senator Hicks:** As recorded by them.

**The Chairman:** Thank you very much for your presentation. We would have had, of course, many further questions, but time is marching on. As far as Dr. Brown is

concerned, I am afraid that he will have to return some time in November.

**Dr. Brown:** We will be glad to.

**The Chairman:** I say that because I do not believe that we have properly considered your brief today. Thank you very much.

The committee adjourned.

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Appendix "43"

MEDICAL RESEARCH COUNCIL

Submission to the  
Special Committee on Science Policy  
of  
The Senate of Canada

Ottawa

1975



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A Introduction

1. It is seven years since the Medical Research Council submitted its brief to the Senate Special Committee on Science Policy. During that time the principal organizational change for the Medical Research Council has of course been the fact of its incorporation as an agency operating within the terms of its own Act.

2. The government's decision that legislation for the Council should provide for its continuatio: as a council was well received not only by the Council itself but by the scientific community. Council welcomed too the announcement by the government last year that in developing legislation for the proposed new granting councils it plans no important change in the MRC Act.

3. During the past seven years, the responsibilities of the Medical Research Council have been extended in a number of significant ways and these will be detailed below.

4. The approved objective of the Medical Research Council is "to help attain the quality and scale of research in the health sciences essential to the maintenance and improvement of health services". Its sub-objectives are;

"To expand the scientific and technological base for health care.

To improve the application of scientific principles to health care.

To ensure an adequate research base for education in the health sciences.

To support the training of research investigators in the health sciences.

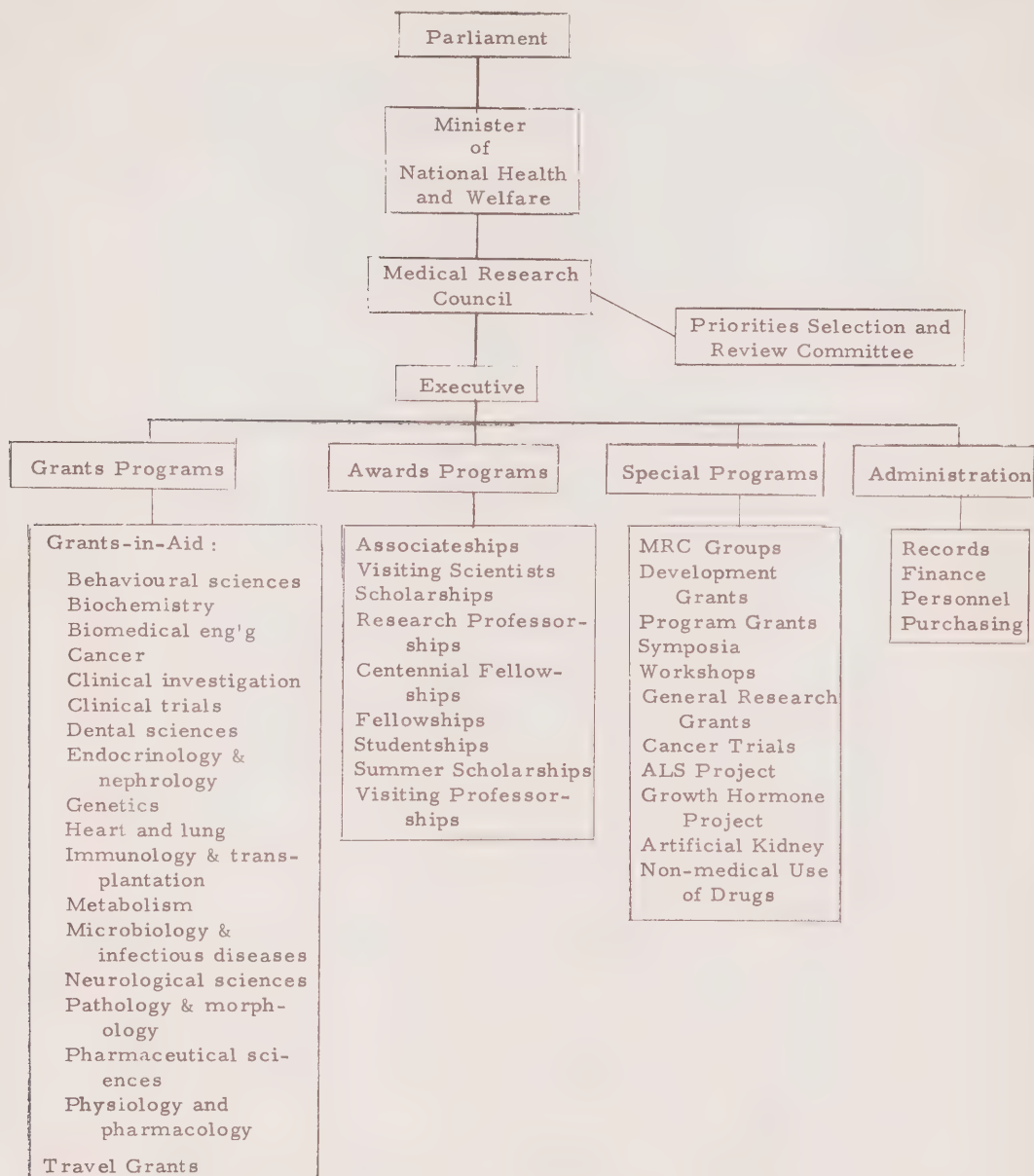
To support research contributing to new knowledge in the health sciences." <sup>1)</sup>

5. Council has continued to maintain an on-going review of the programs designed to discharge its responsibilities and has undertaken numerous specific surveys and studies to obtain data needed for this review. When warranted, some programs of long standing have been expanded and others curtailed -- and not always for reasons related to budget.

6. In consideration of Council's objectives and the achievement of them it needs to be remembered that in Canada research in the health sciences

1) Main Estimates for the year ending March 31, 1976.

is carried out largely in the universities and their teaching hospitals and that in-house government health sciences research and industrial research is relatively small. In other countries, both those larger than Canada and those of a comparable size, the balance among these three sectors is different.





## B Organization

7. Since the submission of its Brief to the Senate Special Committee on Science Policy in December 1968, the Medical Research Council has been established as a departmental crown corporation. Under the terms of its Act (see Appendix A) it continues to report to Parliament through the Minister of National Health and Welfare but remains independent of that department.

8. The chief executive officer of the Council is its President, who holds the appointment during pleasure. The Council itself continues to comprise 21 members (see Appendix B) and in recent years has included representatives of the public at large as well as of the community of health scientists.

9. It is still Council's view that the continual input from working scientists and clinicians is an essential ingredient to the success of its operation. The actual staff of the Council has remained relatively small (see Appendix C) in spite of the increase in administrative responsibilities resulting from its legislation. The number of standing committees of Council, on the other hand, has increased to 25; there are in all 180 members who assist Council with advice and recommendations and ensure that Council maintains the capacity for an overview of the accomplishments, the needs and the opportunities of the health sciences in Canada. The members of all committees, like Council itself, serve without remuneration.

10. The names and composition of the standing committees appear in Appendix D.

## C Function

11. The chief function of the Medical Research Council is to "promote, assist and undertake basic, applied and clinical research in the health sciences...". Seven years ago, its responsibilities lay primarily in the

support of research in the 16 medical schools and in the 8 schools of pharmacy. Its responsibilities were extended in 1969 to include research in the 10 dental schools (formerly the responsibility of the National Research Council).

12. More recently, the government has approved the request of the Department of Veterans Affairs that responsibility for its program for the support of research in its hospitals, together with the appropriate funds, be transferred to the Medical Research Council. This transfer, which is to take effect in 1976, is the culmination of an arrangement adopted six years ago whereby DVA applications were referred to MRC for the assessment of their scientific merit by Council's Grants Committees.

13. Not only have the areas of MRC responsibilities been extended during the past seven years but their boundaries have been more clearly delineated in consultation with other agencies. In January 1975, a joint statement by MRC and the Department of National Health and Welfare was issued with the approval of the Minister (see Appendix E) setting out the particular interests of the Council and the Department's National Health Research and Development Program, the successor to the old Public Health Research Grant. By agreement, and in the light of the newly defined responsibilities, a number of projects formerly funded through the Public Health Research Grant have now been transferred to MRC. The Council also has a special commitment to the research program of the Department's Non-Medical Use of Drugs Directorate and provides grants for university-based research in the pharmacological and biochemical aspects of drug abuse on the recommendation of the Directorate's assessment committees.

14. With the demise of the grants program of the Defence Research Board, announced in the Speech from the Throne in February 1974 to have effect in 1976, university-based research in the area of defence medicine will also become the responsibility of the Medical Research Council though without the corresponding transfer of funds which accompanied the transfer of responsibility from DVA.

D MRC Policy

15. The overall objective of the Medical Research Council is "to help attain the quality and scale of research in the health sciences essential to the maintenance and improvement of health services". Its first responsibility is to provide support across the entire spectrum of the health sciences for approved research proposals that originate in the scientific community. At the present time by far the major portion of Council's expenditures result from the approval, by Council, of research proposals conceived by investigators across the country, of applications from would-be investigators for research training in fields of their own choosing, of requests from universities for assistance in supporting research personnel or research programs, and of a number of activities associated with the general support of research. The chief feature of the program designed to implement the policy of the Medical Research Council is the assessment of all research proposals by peers who apply international standards. While it is not possible to support all meritorious proposals, those which are funded are given amounts sufficient to get the job done.

16. Though acting in large part in response to proposals submitted to it from individual investigators, Council policies find expression in the way in which it allocates to its various programs the funds provided it by Parliament. During the early period of its development, which coincided with the early period of development of the health sciences in Canada, a first priority for the Medical Research Council was the provision of support for personnel, both at the level of research training and in the form of salary support for a limited number of fully trained investigators in the universities.

17. As the picture began to change, Council's policies too have been altered. In 1970, a survey of research trainees in the health sciences carried out by the Medical Research Council indicated the development of certain imbalances. Following consultation with a number of organizations, including one representing the graduate students themselves, Council made

a number of specific adjustments in its own programs. Some restriction was placed on the support available to foreign trainees, limitations were placed on the number and category of research trainees who would be supported under MRC operating grants, and some preference was given in the Fellowship competition for candidates proposing to take research training in designated fields which appeared in need of increased capability. A survey of research trainees two years later showed that these steps were having their effect.

18. More recently one of Council's most successful programs, the Associateships Program, has been seen by Council to have achieved its objectives. These objectives were to demonstrate the important contribution to be made within a medical school by a virtually full-time investigator, and to provide an opportunity (very seldom available when the Program was initiated in 1956) for a few investigators in the health sciences to devote a major portion of their time to research. Intake into this Program which provides for the salary support of a limited number of career investigators has been discontinued this year. Council will of course continue to support its 74 current Associates on the terms under which they took up their appointments.

19. Changes in policy are not lightly or abruptly made. Consultation is taken with the scientific societies both in the basic and clinical sciences, with the Association of Canadian Medical Colleges and its counterparts in the fields of pharmacy and dentistry. In November 1974, the Medical Research Council (augmented for the occasion by a number of its committee chairmen and other consultants) had a special two-day meeting for the single purpose of reviewing Council's policies. In advance of the meeting eighteen organizations were invited to submit comments and recommendations on MRC programs; 16 responded, and these submissions were circulated to all participants in the meeting so that the societies' perceptions of Council policies could be taken into account.

20. One of the five main points on which a consensus was reached at that meeting was that Council should increase that portion of its funds



oriented to areas of national priority and identify funds for target areas.

In this context the words "target areas" had to do with health problems.

21. There are various ways to identify health problems. They may be identified and put in order of importance by examination of morbidity and mortality statistics and of estimates of economic burden. Health problems as perceived by the public at large may be ranked in an order different from that suggested by statistical material. Finally Council may identify health problems not yet perceived as such by the community at large and perhaps not yet reflected in various statistics. After identification of health problems by any or a combination of these methods, it is the responsibility of Council to determine those problems which would be suitable "target areas", i. e. an area not only concerned with an important health problem but also an area in which there are indications that research will make a contribution in the short or medium term, over a period of two to ten years.

22. During the past 12 months, identification of target areas and development of mechanisms for the strategic support of short and medium term research in those areas have been the chief concern of the Council's 8-member Priorities Selection and Review Committee. This Committee reports directly to Council. It has responsibilities for identifying and reviewing scientific priorities for subsequent examination by Council, and for making recommendations concerning the adjustment of current programs or the development of new programs to further Council's progress towards its objectives.

23. The Priorities Selection and Review Committee has recently submitted a number of specific recommendations to Council. These were accepted and it is hoped that even in this period of constraints on budget some of them can be implemented.

24. In addition to keeping its own programs under constant review, Council also plays a leading role in development of policy in respect to matters of general scientific concern. An Ad hoc committee of the Medical Research Council is currently developing recommendations to

Council as to guidelines for handling recombinant DNA molecules and certain animal viruses and cells. Another Working Group has been asked to study current legislation, policies and practices in Canada and elsewhere and recommend to Council guidelines and procedures for the ethical assessment and surveillance of human experimentation. It is confidently expected that the work of these groups will have its influence far beyond the programs of Council itself.

E Relationships with Other Agencies

25. The relationship between the Medical Research Council and other federal agencies concerned with the health field has been referred to above. As a matter of government policy, the number of federal agencies involved in the support of extramural research in the health field has been reduced to two in the past year with the transfer to MRC of responsibilities for extramural health research formerly supported by DVA and DRB. There is an MRC/HWC Coordinating Committee for the formal consideration of mutual concerns and the Director General of the department's Research Programs Directorate is an Associate Member of the Medical Research Council.

26. Formal contact between the Medical Research Council and the National Research Council is maintained by having MRC's President and NRC's Vice-President (University Grants and Scholarships) serve as Associate Members of the other Council.

27. Of more direct pertinence however is the working committee, the Tri-Council Coordinating Committee which comprises the senior officials of each of the three federal granting councils and of the Ministry of State for Science and Technology. Officials of other departments or agencies are also invited to attend the Committee's meetings when matters of concern to them are under consideration. The TCCC, of which the chairmanship rotates annually among the councils, meets regularly approximately every 6 weeks and has been an increasingly useful forum for discussions of federal policy in matters relating to university research,

program mechanisms, and overview of the division of responsibilities among councils.

28. Relationships between the Medical Research Council and provincial agencies have been of two types: formal meetings at which policies and objectives have been discussed, and less formal but more frequent consultations at the working and program level. As additional agencies with special responsibilities for the provincial support of health research are established it can be expected that these relationships will be extended.

29. Relationships with the voluntary agencies continue to be close and cordial. The President of MRC is a member of the National Cancer Institute of Canada and of the Advisory Board of the Ontario Cancer Treatment and Research Foundation.

30. The Interdepartmental Medical Research Coordinating Group which has continued to lead its informal but very useful existence since 1947 has now in fact been reduced to two "members" -- Medical Research Council and Health and Welfare Canada -- but will, we hope, continue. The reasons for its existence have changed from those which led to its formation. It now exists primarily to convene each Fall, a meeting between federal, provincial and voluntary agencies with major concern for research in the health field at which changes in program or policy are discussed and budgetary reports exchanged.

31. Since the Special Committee completed its earlier round of hearings, the Minister of National Health and Welfare has announced in 1973 the formation of a new committee bringing together federal, provincial and voluntary agencies who have major responsibilities in the field of cancer research. The Cancer Research Coordinating Committee comprises senior officials of the Medical Research Council, Health and Welfare Canada, the National Cancer Institute of Canada and the Ontario Cancer Treatment and Research Foundation. It is a coordinating, rather than an executive, body but it has already been instrumental in organizing a number of national collaborative clinical

trials related to the treatment of certain types of cancer.

32. The support of research in educational institutions is, of course, the de facto reason for the existence of the Medical Research Council because it is in the universities and their affiliated or associated institutions that by far the greatest part of health science research is carried out in Canada. It continues to be Council's policy, and therefore function, to provide support for high quality work and to provide the incentives to encourage development and improvement where these are needed. To this end, the activities of the Medical Research Council are of three types:

- a) Grants Programs
- b) Awards Programs
- c) Special Programs

all of which are devoted to the funding of extramural research.

33. The procedures for implementing these programs were outlined in section II 11(a) (p. 4178) of Appendix 31 to the Proceedings of the Special Committee on Science Policy, February 13, 1969.

F Review Procedures and Outside Studies

34. Reference has already been made above to the establishment in 1972 of a standing Priorities Selection and Review Committee. This Committee, which includes members and non-members of Council, has met a total of 19 times for one- or two-day sessions, 10 of them during the past year. The Priorities Committee has commissioned reports, from expert consultants in the fields involved, on thirteen different areas of research in the health sciences. These consultants have generally been drawn from the Canadian scientific community but have, when appropriate, been from industry or an American university. In a number of instances, consideration of the consultants' report has been followed by personal discussions with them.

35. Council has on occasion convened "conferences" of groups of individuals directly affected by its programs for discussion of the policies



for those programs or of broader topics of concern to the group involved. Notable among these conferences have been the meeting of MRC Associates in 1973 and that of MRC Scholars in 1971.

36. The eight-member Executive has an important responsibility to maintain scrutiny of Council's operations. It meets some ten times a year to review Council's financial situation, discuss current policies and develop alternatives for consideration by Council.

37. The procedure for the review of individual projects supported by the Medical Research Council remains essentially as described in Appendix 31, op. cit., section II 11(c) (p. 4180).

#### G Distribution of Activities

38. The regional distribution of MRC funds during 1974-75 is shown in Table 1. The distribution naturally reflects the number of faculties of medicine, dentistry and pharmacy in each province.

Table 1	
MRC Expenditures by Province	
<u>Province</u>	<u>1974-75</u>
British Columbia	\$ 2,777
Alberta	3,520
Saskatchewan	1,262
Manitoba	2,705
Ontario	14,117
Quebec	14,314
New Brunswick	-
Nova Scotia	1,122
Prince Edward Island	-
Newfoundland	551
Sub-total	40,368
General support	155
Outside Canada	2,337
Grand Total	<u>42,860</u>

39. All programs of the Medical Research Council contribute to the development of research. Of special concern to Council has been the fact that some schools within its areas of responsibility, and by no means necessarily those most recently established, have yet to achieve a level of research activity which is considered adequate to provide the necessary back-up to professional education and health care in the region.

Council has made it a special point to identify and encourage development of research in these schools. This will not be achieved by lowering the standards of scientific acceptability of applications from such schools but by encouraging the recruitment of additional competent investigators who will be successful in the subsequent competition for funds. MRC Development Grants are specifically designed to provide salary support, operating funds, and if necessary equipment, for a limited period to enable new recruits to establish research programs in departments designated as eligible for support through this program. To date, 130 investigators have been assisted and the majority are contributing very ably to the development of research in their universities.

40. The Priorities Selection and Review Committee has recently recommended to Council the establishment of a new type of Development Grant, directed not to new recruits to a faculty but to the development of new initiatives in heart research. Council has approved the establishment of Heart Research Development Grants but may have to defer their implementation for budgetary reasons.

41. One of the major efforts of the Medical Research Council has been the encouragement of intensive research, often interdisciplinary in nature, on the part of a group of investigators interested in collaborative research. The first of these so-called MRC Groups was established at l'Université de Montréal in 1967. In establishing a Group, MRC undertakes to provide full funding for the operation of the research program so that there will be no need to seek additional funds elsewhere, and if necessary, salary support for the investigators themselves as well as their trainees and assistants. The university involved undertakes to provide adequate facilities and to relieve the investigators of undergraduate teaching and administrative duties.

42. There are now 10 MRC Groups involving 46 investigators in all, most of whom already have international reputations in their chosen field:

		<u>Director(s)</u>
1967	MRC Group in Neurosciences, Université de Montréal	Dr. H. H. Jasper
1970	MRC Group for Transplantation Research, University of Alberta	Dr. J. B. Dossetor Dr. E. Diener
1971	MRC Group in Drug Toxicology, Université de Montréal	Dr. G. L. Plaa
1971	MRC Group in Developmental Neurobiology, McMaster University	Dr. J. Diamond
1972	MRC Group in Medical Genetics, McGill University	Dr. F. C. Fraser
1972	MRC Group on Hypertension, Clinical Research Institute of Montreal	Dr. J. Genest
1973	MRC Group in Allergy Research, University of Manitoba	Dr. A. Sehon
1973	MRC Group in Periodontal Physiology, University of Toronto	Dr. A. H. Melcher
1973	MRC Group in Molecular Endocrinology, Université Laval	Dr. F. Labrie
1974	MRC Group in Protein Structure and Function, University of Alberta	Dr. C. M. Kay Dr. L. B. Smillie

43. As an indication of the size of individual programs, Table 2 sets out the numbers of grants and personnel awards of various categories held during the period 1968-69 to 1974-75.

Table 2

The number of Medical Research Council grants and personnel awards held since the Council last reported to the Committee are as follows

Year	Grants	Groups	Development Grants	Fellow- ships*	Student- ships	Scholar- ships	Associate- ships
1968-69	1,332	1	28	329	234	105	72
1969-70	1,437	1	34	382	284	119	83
1970-71	1,437	2	34	383	302	127	85
1971-72	1,491	4	31	397	302	142	83
1972-73	1,383	6	37	342	262	137	78
1973-74	1,411	9	35	351	259	143	78
1974-75	1,452	10	37	326	227	140	75

\* Including Centennial Fellowships

II Expenditures Associated with Scientific Research

44. The Medical Research Council makes no capital expenditures.

Its expenditures, by program, for the period 1968-69 to date are set out in Table 3. In addition to the Vote for Grants and Scholarships (which comprises all MRC extramural funds), we have also recorded the Administrative Vote which represents the total costs of administering the programs.

Table 3

## MEDICAL RESEARCH COUNCIL

Expenditures, 1968-75

VOTE 60 - Grants & Scholarships	68-69	69-70	70-71	71-72	72-73	73-74	74-75
	(\$ thousands)						
<u>Grants Programs</u>							
Grants-in-Aid	19,201	20,771	22,483	23,568	23,837	26,300	27,402
Development Grants	609	990	1,230	853	988	762	957
MRC Groups	223	223	543	941	1,941	2,499	3,626
Special Projects	109	211	260	460	495	423	614
Subtotal	20,142	22,195	24,516	25,822	27,261	29,984	32,599
<u>Awards Programs</u>							
Associateships	1,272	1,569	1,661	1,674	1,723	1,871	1,951
Scholarships	1,411	1,688	1,776	2,015	2,175	2,372	2,351
Centennial Fellowships	194	247	261	274	310	253	311
Fellowships	2,205	2,706	2,895	3,140	3,479	3,400	3,621
Studentships	573	1,008	1,033	1,086	1,013	963	919
Summer Scholarships	235	319	260	410	312	308	210
Travel grants to trainees	20	22	15	10	20	11	6
Subtotal	5,910	7,559	7,901	8,609	9,032	9,178	9,369
<u>Other Programs</u>							
Visiting Scientists	303	155	202	145	163	206	89
General Research Grants	424	810	1,215	815	820	820	624
Symposia	34	38	35	46	47	49	24
Cdn. Council on Animal Care	21	50	40	60	60	60	60
Miscellaneous	109	84	53	145	77	63	95
Subtotal	891	1,137	1,545	1,211	1,167	1,198	892
Total	26,943	30,891	33,962	35,642	37,460	40,360	42,860
VOTE 55 - Operating Expenses	268	324	402	473	540	769	853
GRAND TOTAL	27,211	31,215	34,364	36,115	38,000	41,129	43,713



45. It will be noted that the Grants Program accounts for by far the major portion of the expenditures of the Medical Research Council, Though expenditures are increasing, "demand" continues to outstrip "supply" by a wide margin.

Table 4	
Grants Program 1968-69 to 1974-75	
Year	Dollar Award Rate
1968-69	54%
1969-70	46%
1970-71	48%
1971-72	46%
1972-73	47%
1973-74	53%
1974-75	46%

46. The expenditures of the Medical Research Council in 1974-75 represented 75% of the funds for extramural health science research from federal agencies in the fields and 50% of the total provided by all sources.

47. In January 1975 the Medical Research Council, with the co-operation of the Association of Canadian Medical Colleges, distributed a questionnaire to 108 of its grantees, selected at random, to seek up-to-date information on their research costs under a number of headings. Within the month very detailed and valuable information had been obtained. Using extrapolations from these data as a base, and with additional information concerning new salary agreements with technicians, Council is maintaining an "index" of research costs in the health field across the country.

I Reports of Medical Research Council

48. The Council issues each year a "Grants and Awards Guide" describing its programs in detail and the method of application for each.

49. The "Report of the President" of the Medical Research Council published at the end of each fiscal year for submission to Parliament includes a complete list of all projects or programs supported and the names of the recipients of all personnel awards. The Report for 1974-75 is appended. Copies of earlier Reports are available on request.

50. In addition, a quarterly Newsletter is published for distribution to the university community and others on request.

51. Each summer the Council also compiles, with the collaboration of other federal, provincial and voluntary agencies, a "Reference List of Health Science Research in Canada" which lists and cross-indexes the recipients and titles of all grants and awards approved by the 33 agencies involved up to the end of June of the current fiscal year.

J Transfer of Research Results

52. Grantees and trainees of the Medical Research Council are free to publish the results of their research. Publication of the results is, of course, the natural outcome of their work and has some bearing on the continuation of their support. Over the years, MRC support has given rise to thousands of publications; reports from its grantees will be found in a large number of health science journals of repute, Canadian or foreign.

53. There are, of course, other ways of disseminating information. One of these is the transfer which occurs between the researcher and his colleagues in the region; this will have its influence both on the directions of local research and on the improvement of patient care.

54. The transfer at the local level is subsequently extended by the presentation of papers at meetings of research societies. The Canadian Society of Clinical Investigation and the Canadian Federation of Biological

Societies are two of the principal Canadian forums in this context.

55. Council has continued its modest but effective program for the exchange, between Canadian centres, of investigators who give lectures or graduate seminars in their areas of expertise. It has restricted somewhat, for financial reasons, its Visiting Scientist Program which is designed to enable Canadian investigators to work in foreign laboratories, but the need for this program has diminished in recent years as universities have developed policies with respect to sabbatical leave. Council hopes that in future greater use will be made of this program to bring foreign investigators to this country for 3-12 months of collaborative research with their Canadian colleagues.

56. A valuable contribution to the transfer of research results is also made by postdoctoral Fellows. Even though still in training they add greatly to the laboratories in which they work and it is often at this level that new and specialized techniques are transferred from abroad to Canada or from Canada to foreign laboratories.

57. Council has played its part in the support of symposia and conferences held in Canada in its area of responsibility. It has recently reviewed, and made important changes in, its policy for the support of scientific meetings. Henceforth, Council proposes to take more initiative in the sponsorship of workshops of 10-30 persons who are invited to discuss specific topics of scientific concern or opportunity. This mechanism has proven effective in establishing closer communication among workers in related fields, leading to collaboration and teamwork of an interdisciplinary nature. One such Workshop, on Spasmodic Torticollis, was recently held in Ottawa.

58. Of interest in the context of that most important transfer of the results of MRC-supported research from the researcher, be he or she a "basic" or "applied" or "clinical" researcher to the clinician who can apply the results to the treatment of patients, is an analysis made of the Annual Meeting of the Royal College of Physicians and Surgeons held January 23-26, 1974.

59. The Royal College has as its primary function the maintenance of high standards of medicine and surgery in this country: It sets the examinations which identify qualified specialists. It is a major contributor to the continuing education of these physicians and surgeons and one of the chief tools is the 4-day Annual Meeting. The 1974 Annual Meeting was attended by 2,460. A large part of the program is given over to frankly didactic sessions, symposia, reviews, "advances in...", and lectures.

*51 of the papers presented in these sessions in 1974  
were by MRC grantees and award holders.*

60. Other parts of the meeting are given over to the presentation of first order scientific papers.

*107 of the papers in 1974 were presented by MRC  
grantees and award holders.*

61. The Royal College honours outstanding individuals by the award each year of a Medal in Surgery, a Medal in Medicine, Lectureships in Medicine, Surgery and Obstetrics and Gynaecology, and by a very limited number of Honourary Fellowships.

*For 1974 the Medallist in Medicine, the  
Medallist in Surgery, the Royal College  
Lecturer in Medicine (the other two Royal  
College Lecturers were from France and the  
United States) and two of the three Canadians  
given Honourary Fellowships were MRC grantees.*



## Appendix A

Revised Statutes of Canada 1970  
Volume V

## CHAPTER M-9

An Act respecting the Medical Research  
Council

## SHORT TITLE

Short title      **1.** This Act may be cited as the *Medical Research Council Act*.

## INTERPRETATION

Definitions      **2.** In this Act  
"Council"      "Council" means the Medical Research Council established by section 3;  
"Minister"      "Minister" means the Minister of National Health and Welfare, 1968-69, c. 28, s. 54.

## COUNCIL ESTABLISHED

Council established      **3.** A corporation is hereby established to be called the Medical Research Council consisting of a president and not more than twenty-one other members to be appointed by the Governor in Council as provided in section 5, 1938-69, c. 28, s. 55.

## FUNCTIONS

Functions of Council      **4. (1)** It is the function of the Council to  
(a) promote, assist and undertake basic, applied and clinical research in Canada in the health sciences, other than public health research; and

(b) advise the Minister in respect of such matters relating to such research as the Minister may refer to the Council for its consideration.

Powers      **(2)** The Council, in carrying out its functions under subsection (1), may

(a) expend, for the purposes of this Act, any money appropriated by Parliament for the work of the Council or received by the Council through the conduct of its operations;

(b) acquire any money, securities or other property by gift, bequest or otherwise, and expend, administer or dispose of any such money, securities or other property, subject to the terms, if any, upon which such money, securities or other property is given, bequeathed or otherwise made available to the Council; and

(c) subject to the approval of the Minister, publish and sell or otherwise distribute such scientific and technical information as the Council deems necessary. 1968-69, c. 28, s. 56.

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## ORGANIZATION

Appointment of President	<b>5.</b> (1) The President of the Council shall be appointed to hold office during pleasure.
Other members	(2) Each of the other members of the Council shall be appointed to hold office during pleasure for such term, not exceeding three years, as will ensure as far as possible the expiration in any one year of the terms of appointment of fewer than half of the members so appointed.
Eligibility for re-appointment	(3) A retiring member of the Council is eligible for re-appointment to the Council. 1968-69, c. 28, s. 57.
Vice-President	<b>6.</b> (1) The Council may, with the approval of the Governor in Council, elect one of its members to be Vice-President of the Council.
Absence, etc., of President	(2) In the event of the absence or incapacity of the President of the Council, or if the office of President is vacant, the Vice-President has and may exercise and perform all the duties and functions of President. 1968-69, c. 28, s. 58.
Salary and expenses of President	<b>7.</b> (1) The President of the Council shall be paid such salary and expenses as are fixed by the Governor in Council.
Remuneration and expenses	(2) The members of the Council, other than the President, shall serve without remuneration but each such member is entitled to be paid reasonable travelling and other expenses incurred by him while absent from his ordinary place of residence in the course of his duties under this Act.
Remuneration of members for additional duties	(3) Notwithstanding subsection (2), a member of the Council other than the President may, for any period during which he performs with the approval of the Council any duties on behalf of the Council in addition to his ordinary duties as a member thereof, be paid such remuneration therefor as may be authorized by the Governor in Council. 1968-69, c. 28, s. 59.
Head office	<b>8.</b> (1) The head office of the Council shall be in the National Capital Region described in the schedule to the <i>National Capital Act</i> .
Meetings	(2) The Council shall meet at least twice a year and may meet at such other times as it deems necessary. 1968-69, c. 28, s. 60.
Direction of work and staff	<b>9.</b> The President is the chief executive officer of the Council and has supervision over and direction of the work and staff of the Council. 1968-69, c. 28, s. 61.

Executive committee	<p><b>10. (1)</b> There shall be an executive committee of the Council consisting of the President, the Vice-President and at least six other members selected by the Council.</p>
Duties of executive committee	<p><b>(2)</b> The executive committee of the Council may exercise and perform such of the powers and functions of the Council as the Council may by by-law assign to it and shall submit at each meeting of the Council minutes of its proceedings since the last preceding meeting of the Council. 1968-69, c. 28, s. 62.</p>
By-laws	<p><b>11. (1)</b> The Council may make by-laws for the regulation of its proceedings and generally for the conduct of its activities including the establishment of <i>ad hoc</i>, standing and other committees of the Council.</p>
Advisory committees	<p><b>(2)</b> Any by-law made pursuant to subsection (1) establishing an advisory committee of the Council may provide for the membership thereon of persons other than members of the Council, in addition to members of the Council. 1968-69, c. 28, s. 63.</p>
Appointment of staff	<p><b>12. (1)</b> The Council may, with the approval of the Minister,</p> <p><b>(a)</b> appoint such officers and employees as are necessary for the proper conduct of the work of the Council; and</p> <p><b>(b)</b> prescribe the duties of such officers and employees and the conditions of their employment.</p>
Salaries and expenses of staff	<p><b>(2)</b> The officers and employees of the Council appointed as provided in subsection (1) shall be paid such salaries and expenses as are fixed by the Council with the approval of the Governor in Council. 1968-69, c. 28, s. 64.</p>
Council agent of Her Majesty	<p><b>13. (1)</b> The Council is for all purposes an agent of Her Majesty and its powers may be exercised only as an agent of Her Majesty.</p>
Contracts	<p><b>(2)</b> The Council may on behalf of Her Majesty enter into contracts in the name of Her Majesty or in its own name.</p>
Property	<p><b>(3)</b> Any property acquired by the Council is the property of Her Majesty and title thereto may be vested in the name of Her Majesty or in the name of the Council.</p>
Proceedings	<p><b>(4)</b> Actions, suits or other legal proceedings in respect of any right or obligation acquired or incurred by the Council on behalf of Her Majesty, whether in its name or in the name of Her Majesty, may be brought or taken by or against the Council in the name of the Council in any court that would have jurisdiction if the Council were not an agent of Her Majesty. 1968-69, c. 28, s. 65.</p>

A - 4

Application of  
*Public Service  
Superannuation  
Act*

14. The *Public Service Superannuation Act* does not apply to members of the Council, other than the President, unless in the case of any such member the Governor in Council otherwise directs. 1968-69, c. 28, s. 66.

#### FINANCIAL

Appropriations

15. All amounts required for the payment of salaries and other expenses under this Act including expenses of administration shall be paid out of moneys appropriated by Parliament for the purpose. 1968-69, c. 28, s. 67.

#### AUDIT

Audit

16. The accounts and financial transactions of the Council shall be audited annually by the Auditor General of Canada, and a report of the audit shall be made to the Council and to the Minister. 1968-69, c. 28, s. 68.

#### REPORT

Annual report

17. The President of the Council shall, within four months after the termination of each fiscal year, transmit to the Minister a report relating to the activities of the Council for that fiscal year, including the financial statements of the Council and the Auditor General's report thereon, and the Minister shall cause such statement to be laid before Parliament within fifteen days after the receipt thereof or, if Parliament is not then sitting, on any of the first fifteen days next thereafter that Parliament is sitting. 1968-69, c. 28, s. 69.



## Appendix B

**PRESENT COMPOSITION OF THE MEDICAL RESEARCH COUNCIL  
COMPOSITION ACTUELLE DU CONSEIL DE RECHERCHES MÉDICALES**

*President  
Président*

G. MALCOLM BROWN, M.D., C.M., D. Phil., L.L.D., D.Sc., M.D. (Hon.), F.R.C.P., F.R.C.P.(C),  
M.A.C.F.

*Vice-President  
Vice-Président*

PIERRE BOIS, M.D., Ph.D.  
*Doyen de la Faculté de Médecine, Université de Montréal*

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*Dean of Pharmacy, University of Toronto*

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*General Practitioner, Henderson General Hospital, Hamilton*

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*Professor of Experimental Medicine McGill University*

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*Professeur agrégé, Département de microbiologie, Université de Sherbrooke*

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*Professor of Medicine, University of Manitoba*

JEAN DE MARGERIE, B.A., M.D., D. Phil., F.R.C.S.(C), F.A.C.S.  
*Professeur et Directeur, Département d'Ophtalmologie, Université de Sherbrooke*

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*Professor and Head, Department of Anatomy, University of Saskatchewan*

JACQUES GENEST, C.C., M.D., F.A.C.P.(C), F.R.S.C., F.R.S.M.  
*Directeur scientifique, Institut de recherches cliniques de Montréal*

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*Professor and Head, Department of Pathology, Queen's University*

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*Director, School of Nursing, McMaster University*

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*1040 Moncton, Québec, Québec*

BERNARD LANGER, M.D., F.R.C.S.(C), F.A.C.S.  
*Associate Professor of Surgery, University of Toronto*

FRANKLIN W. LOVELY, D.D.S., M.Sc., F.R.C.D.(C)  
*Professor and Head, Department of Oral Surgery, Faculty of Dentistry, Dalhousie University*

KEITH L. MACCANNELL, M.D., B.Sc. (Med), Ph.D., F.R.C.P.(C)  
*Professor and Head, Division of Pharmacology and Therapeutics, University of Calgary*

BARRY C. MCBRIDE, B.Sc., M.Sc., Ph.D.  
*Assistant Professor of Oral Biology and of Microbiology, University of British Columbia*

ERNEST E. MCCOY, M.D., F.R.C.P.(C)  
*Professor and Chairman, Department of Paediatrics, University of Alberta*

HUGH MCLENNAN, Ph.D.  
*Professor of Physiology, University of British Columbia*

LOUIS J. POIRIER, O.C., B.A., M.D., Ph.D., D. de l'U. (Rennes)  
*Professeur et Directeur, Département d'Anatomie, Université Laval*

LORRAINE MACDONALD SWEATMAN, B.A.  
*206 Kingsway, Winnipeg, Manitoba*

LESLIE S. VALBERG, M.D., M.Sc., F.R.C.P.(C), F.A.C.P.  
*Professor and Chairman of Medicine, University of Western Ontario*

*Associate members  
Membres associés*

B.A. GINGRAS, B.Sc., M.Sc., Ph.D., D.Phil., F.C.I.C.  
*Vice-président (Subventions et Bourses universitaires), Conseil national de recherches au Canada*

\* N. JACK B. WIGGIN, M.D., C.M., M. Sc. (Med), Ph.D.  
*Director General, Research Programs Directorate, Health and Welfare Canada*

\* Retired as of 31 December 1975

A pris sa retraite le 31 décembre 1975

Appendix C

Medical Research Council

Employees 1971-76

31 March 1972	24(9)*
31 March 1973	27(10)
31 March 1974	30(10)
31 March 1975	33(10)
31 March 1976	37(12)

\* Figures in brackets represent those in executive, scientific and professional, and administrative and foreign service categories.

## Appendix D

## Executive Committee/Le Comité de direction

G. Malcolm Brown (*Chairman*). . . . . Medical Research Council  
Pierre Bois. . . . . Université de Montréal  
Margaret R. Becklake. . . . . McGill University  
Jean de Margerie. . . . . Université de Sherbrooke  
Bernard Langer. . . . . University of Toronto  
Keith L. MacCannell. . . . . University of Calgary  
Barry C. McBride. . . . . University of British Columbia  
Ernest E. McCoy. . . . . University of Alberta

Priorities Selection and Review Committee/  
Le Comité de révision et de sélection des priorités

G. Malcolm Brown (*Chairman*). . . . . Medical Research Council  
Michel Chrétien. . . . . Institut de recherches cliniques  
de Montréal  
George E. Connell. . . . . University of Toronto  
John Gutelius. . . . . Queen's University  
Nathan Kaufman. . . . . Queen's University  
Arnold Naimark. . . . . University of Manitoba  
Hugh McLennan. . . . . University of British Columbia  
Lorraine Sweatman. . . . . Winnipeg  
Leonhard S. Wolfe. . . . . Montreal Neurological Institute

D-2

## GRANTS COMMITTEES/COMITÉS DE SUBVENTION

1975-1976

BEHAVIOURAL SCIENCES  
SCIENCES DU COMPORTEMENT

GREGORY M. BROWN (*Chairman*) . . . . . University of Toronto  
 DAVID BÉLANGER . . . . . Université de Montréal  
 JOHN M. CLEGHORN . . . . . McMaster University  
 ROBERT D. HARE . . . . . University of British Columbia  
 FELIX J. LETEMENDIA . . . . . Queen's University  
 BRENDA MILNER . . . . . McGill University  
 DONALD E. MITCHELL . . . . . Dalhousie University  
 JAMES INGLIS (*Scientific Officer*) . . . . . Queen's University

BIOCHEMISTRY  
BIOCHIMIE

WILLIAM W. KAY (*Chairman*) . . . . . University of Saskatchewan  
 PHILIP D. BRAGG . . . . . University of British Columbia  
 M. CLELIA GANOZA . . . . . University of Toronto  
 ROBERT GIANETTO . . . . . Université de Montréal  
 CHRISTOPHER W. HELLEINER . . . . . Dalhousie University  
 WILLIAM PARANCHYCH . . . . . University of Alberta  
 BRUCE H. SELLS . . . . . Memorial University of Newfoundland  
 FRITS C. STEVENS . . . . . University of Manitoba  
 JOHN H. SPENCER (*Scientific Officer*) . . . . . McGill University

BIOMEDICAL ENGINEERING  
GÉNIE BIO-MÉDICAL

FERNAND A. ROBERGE (*Directeur*) . . . . . Université de Montréal  
 ANTHONY M. ALBISSER . . . . . University of Toronto  
 DAVID BURKE . . . . . McGill University  
 CHARLES A. LASZLO . . . . . University of British Columbia  
 STANLEY ROWLANDS . . . . . University of Calgary  
 DAVID A. WINTER . . . . . University of Waterloo  
 JAMES M. ROXBURGH (*Scientific Officer*) . . . . . Medical Research Council

CANCER  
CANCER

PHIL GOLD (*Chairman*) . . . . . McGill University  
 MICHAEL A. BAKER . . . . . University of Toronto  
 JUDITH K. BALL . . . . . University of Western Ontario  
 J. FRANK HENDERSON . . . . . University of Alberta  
 ALLAN S. MacDONALD . . . . . Dalhousie University  
 T. ALEXANDER McPHERSON . . . . . University of Alberta  
 ROBERT K. MURRAY . . . . . University of Toronto  
 MICHEL PAGÉ . . . . . Université Laval  
 ROSE SHEININ (*Scientific Officer*) . . . . . University of Toronto

CLINICAL INVESTIGATION  
RECHERCHE CLINIQUE

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1975-1976

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## Appendix E

**SUPPORT FOR RESEARCH PROJECTS BY MRC AND HEALTH AND WELFARE CANADA**

The following joint statement is being issued concurrently by the Council and the Department.

**Purpose:**

To delineate the types of research projects which will be considered in 1975-76 for support in 1976-77 by Health and Welfare Canada under its National Health Research and Development Program and by the Medical Research Council.

**Limitations:**

The objectives and priorities of the two programs to which such research projects contribute are not set out here nor are the procedures for application, assessment and administration. Activities other than research projects which may receive support are not described.

**I. Medical Research Council**

Support for research projects in the health sciences whether basic, applied or clinical will be considered including clinical trials for the assessment and validation of diagnostic and treatment procedures but not including health care research as described below under II. Research projects in the field of the methods of education of health professionals will also be considered as will proposals for historical research having to do with the health sciences.

Applicants will normally be expected to hold an academic or equivalent appointment in a health science faculty (medicine, dentistry, pharmacy, optometry or nursing) of a Canadian university or affiliated hospital or institute but applications from suitably qualified investigators in other faculties or institutions will be considered if the relevance to human health is clear and direct.

**II. National Health Research and Development Program  
Health and Welfare Canada**

Under the general definition of Health Care Research support will be considered for projects of national interest involving the systematic enquiry into:

- a) the biology of human populations;
- b) the health implications of existing and emerging personal, community and occupational environments, life styles and health related practices;



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- c) the impediments to and possible measures to stimulate adoption of improved life styles and health related practices;
- d) the application of scientific knowledge to prevention of disease, maintenance of health and improvement of health status of populations and environmental factors which affect health;
- e) the need for, process of and effectiveness of personal, community, regional and other health services having national significance;
- f) the implications of new and impending scientific and technological developments in such fields as transportation, housing and diagnostic and therapeutic measures and equipment, etc., in terms of their probable impact on future environments, life styles and systems of health care delivery;
- g) the health implications of current and imminent cultural, social and economic transitions as causative factors leading to significant changes in interpersonal relationships and the general physical, social and psychological environment.

(Item e) is intended to include research on health manpower requirements and the relationship between the content of educational programs for health personnel and their current, projected or desirable roles.)

Applications from any agency, association, corporation, institution, individual or other body capable of conducting activities falling within the terms of reference of the National Health Research and Development Program will be given consideration for support. In special cases applications from governments of provinces or municipalities or departments thereof may be considered.

Appendix "44"

ASSOCIATION OF CANADIAN MEDICAL COLLEGES  
ASSOCIATION DES FACULTES DE MEDECINE DU CANADA

BRIEF SUBMITTED TO THE  
SPECIAL COMMITTEE ON SCIENCE POLICY  
OF  
THE SENATE OF CANADA

OTTAWA

1976

SUBMISSION TO THE SENATE COMMITTEE ON SCIENCE POLICY

BY THE

ASSOCIATION OF CANADIAN MEDICAL COLLEGES1. INTRODUCTION

The Association of Canadian Medical Colleges is grateful to the Senate Committee on Science Policy for the invitation extended to it on 14th October 1975. Members of the Executive of the Association of Canadian Medical Colleges and many others in the medical community have studied, with interest, the recommendations of the Senate Special Committee, in the light of the brief submitted to the Senate Committee by our Association in May 1968. The present submission was prepared by the Committee on Research of the Association of Canadian Medical Colleges, and has been approved by the Executive of the Association and the Deans of the sixteen Faculties of Medicine in Canada.

2. COMMENT ON VOLUME II OF REPORT OF SENATE COMMITTEE ON SCIENCE POLICY

The Association of Canadian Medical Colleges noted with interest the recommendation on page 467 of the Senate Committee in Volume II which gave a high priority to Government support for basic research in the life sciences, particularly those related to human health. This priority has not been met. Indeed, there has been, in the opinion of the Association of Canadian Medical Colleges, a serious erosion in the basic science research potential of Canada in the medical sciences. Research support has fallen far behind the amount needed to keep pace with inflationary increases in research costs (as documented below), let alone the amount needed for necessary growth and development.

The Association also noted on the same page of the same volume of the Senate Committee Report a paragraph which recommended

that the Canadian Government might establish basic research activities in the life sciences in a national research academy. In connection with this recommendation, it is the view of the Association of Canadian Medical Colleges that basic research relating to human health and the medical sciences, should be placed either within the jurisdiction of universities, or in close juxtaposition to them. The Association would, therefore, not favour the establishment of basic research institutes which were dissociated from graduate student training and undergraduate teaching.

3. THE ROLE OF THE MEDICAL SCHOOLS IN CANADA

The Association of Canadian Medical Colleges wishes to draw the attention of the Committee to the major expansion in the responsibilities of Canadian Medical Colleges which has occurred between 1962 and 1974. This amounts to a 70% increase in first year student enrolment, as shown on Table I. We also wish to emphasize to the Committee that the Faculties of Medicine in Canada play a most important role in teaching students other than those enrolled in Faculties of Medicine. A major responsibility is the teaching of basic medical science to students in Faculties of Nursing, Dentistry, Pharmacy, and other health disciplines. In addition, the basic science departments of Faculties of Medicine also undertake a considerable teaching load to students of Science in most Canadian Universities. The extent of the teaching load for the year 1974-75 is listed in Table II.

Faculties of Medicine accept the major responsibility for basic and applied research in the medical sciences, and for research in the delivery of health care in Canada. There is very little in-house research in medical sciences in Canada and the medical faculties



accept their role in research because they believe that there is a very close relationship between a vigorous program of inquiry in the different departments in any Faculty of Medicine, and the maintenance of the highest standards of teaching and health care within the communities in which a medical school is placed. It follows from this that major changes in medical research funding in Canada have a direct and primary effect on the programs in the medical school: there is no way that a major reduction in the research funding can be effected without the operation of the medical schools being deeply disturbed, and without damaging consequences on the ability of the medical schools to discharge their academic and teaching functions to an adequately high standard.

#### 4. EVENTS SINCE 1969

The Association of Canadian Medical Colleges' brief to the Committee in 1969 did not foresee the major inflation in costs which has occurred in Canada during the last five years. The Association undertook a study of the impact of inflation on the increase in research costs which had occurred between 1973 and 1975. The results of this study are shown in Tables III to VIII attached to this report. The Association wishes to draw to the attention of the Senate Committee that the average cost increase between September 1973 and September 1974 (as shown in Table VI) was 16.9%. Equipment had increased by 21.3% and laboratory supplies by 23.6%. The Association believes that a further rise of this order of magnitude has occurred during the past year.

In Table IX is listed the funding into Faculties of Medicine by the Medical Research Council for the comparable period, and it is

quite evident that there has been a major short fall between the money available for medical research and its increasing cost. The total grant input into Canadian medical schools shown for two years in Table X indicates that there was a reduction of research money from all sources between 1973 and 1975, whereas the increase in research costs was at least 30% over the same period.

In Table XI are shown comparative data for Canadian expenditure on foreign aid, nuclear research, health research, health care, life style, and environment for the years between 1970 and 1974. It is evident from this Table that, in spite of the recommendations of the Senate Committee on Science Policy, expenditures on health research have had a much smaller increase between 1970 and 1974 than have Canadian expenditures in any of these categories. Some international comparisons are included in Table XII, and a further analysis of the breakdown of Canadian R & D expenditure for the year 1972-73 is shown in Table XIII.

5. PUBLIC SUPPORT FOR MEDICAL RESEARCH FINANCING IN CANADA

Members of the Association of Canadian Medical Colleges are aware that the low level of medical research funding is sometimes attributed to a belief that the Canadian public is not greatly interested in research expenditure in the medical sciences. The Association of Canadian Medical Colleges believes that there is good evidence that the public puts a high priority on such research. As shown in Table XIV, over the same period for which other data has been presented, the Canadian public increased its voluntary contributions to the National Cancer Society and to the Heart Foundations by an amount that enabled these bodies to maintain their

research program in the face of the formidable inflation which had occurred. In the case of the National Cancer Society, the greater part of the contributions to it are solicited by door-to-door contact with members of the Canadian public, and contributions by major business concerns do not constitute a very large part of the total subscribed. This supports the belief of the Association of Canadian Medical Colleges that the public in Canada is very conscious of the long-term benefits of health research and is anxious to do its part to help maintain that initiative. Public subscription of this kind cannot of course provide the necessary research financing for all medical research in a country like Canada, and we do not wish to imply that deficiencies in federal expenditures in this field can be made good by public campaigns. Nevertheless, the data certainly indicates considerable public awareness of the importance of medical research in Canada as a whole; the Association of Canadian Medical Colleges believes that the public is very supportive of expenditure on health research.

6. DIRECT EFFECTS OF CUTS IN MEDICAL RESEARCH COUNCIL BUDGET IN JANUARY 1976

The Association of Canadian Medical Colleges wishes to draw attention to the serious short-term and long-term effects which will follow the Medical Research Council adjustments dictated by present Government policy. The Association wishes to stress that it recognizes that expenditures for medical research must be viewed together with all Canadian research expenditures, and we do not wish to indicate that the reductions in Canadian research potential in the medical sciences are inherently any more damaging to Canada than the reductions made necessary in the budgets of other granting council.

However, the Association of Canadian Medical Colleges feels it has the responsibility to ensure that the Senate Committee on Science Policy is fully informed of the likely consequences of the reduction in Canadian medical research potential which is a consequence of failure to meet the rising costs of research during the last few years.

The most recent budget freeze will lead to cancellation of the following Medical Research Council programs:

- Summer Student Program for 1976
- Research Professorships for 1976
- A special Heart Research Program planned to begin in 1976
- Visiting Science Awards for 1976.

It is understood that there will, in addition, be a reduction in program grants, and a reduction of about 3% in all grants in the operating component. It is believed that these measures will reduce the number of operating grants that can be awarded by between 100 and 150, and this will lead to the loss of employment of a number of well-trained research technicians to medical science in Canada, since these salaries make up about 60% of operating grants.

Equally serious is the general impact of the reduction of programs on the training of young medical scientists. New scholarships have been reduced from 25 to 15; the intake of Fellows in research will be restricted; the award of Centennial Fellowships will be held to a maximum of 5 (compared to a previous maximum of 10), and studentships will also be severely limited. The grant given by the Medical Research Council to the Deans of the Faculties of Medicine is to be reduced by one third. Since much of this money was



used by Deans to support programs of research study by medical students, this will also reduce the opportunities available to enable promising medical undergraduates to study for a short period in a research environment.

It is not possible to quantitate very precisely the long-range impact of these reductions which have been necessitated by the Medical Research Council to meet Treasury Board funding directives. The Association of Canadian Medical Colleges doubts that the long-range adverse implications of these cuts have been fully understood by those who have the responsibility of seeking economies, and in common with other bodies, we wish to stress that in its view, such economies in Canada are shortsighted. Canadian research potential in medical science is modest, since the level of funding for medical science has never, by international standards, been generous in relation to the country's potential. This means that a reduction in research capability at this point of time is particularly serious, since such economies unquestionably mean the loss to research of gifted investigators, and the general climate of discouragement will mean that fewer creative Canadians can afford the risk of undertaking a career in research.

The Association is concerned that the Government's decision to freeze the budgets of the granting councils may have been taken without a full appreciation of the particular nature of extramural research budgets.

The effects of a freeze on extramural grant budgets are, by contrast, even more severe. These budgets must include salary adjustments. This results in a reduction in the effective level of

support available, the necessity to lay off skilled technical staff and the dismantling of a research capability painstakingly built up over several years which will be difficult and very costly to restore. Research techniques are often not easy to learn. The dismissal of a trained technician or a research professional not only diminishes the research potential of a group, but threatens to lose to research many individuals with special skills acquired over many years of training and preparation.

7. RECOMMENDATIONS

- (1) We recommend that the Senate Committee recognize that, despite the high priority it assigned to life sciences research, the Government of Canada has, over the last four years, been responsible for a serious reduction in such research. This has occurred as a result of failure to expand funding to take account of the effect of inflation on research costs.
- (2) We recommend that the Senate Committee recognize that, despite the high priority given to the development of research programs in the areas of concern espoused in the document, "A New Perspective for the Health of Canadians", the ability of the medical school to train research workers in many of the areas identified as requiring new initiative, has been seriously diminished as a result of policies followed since 1969.
- (3) The dismal record of the Federal Government in securing the future of the nation's biomedical research enterprise, suggest that there must be a serious defect in the mechanisms concerned with the development and implementation of science policy in Canada. The Association of Canadian Medical Colleges therefore

recommends that the Senate Committee on Science Policy should, as a matter of urgency, propose that the Science Council should be given the responsibility of reporting regularly to Government on the adequacy of science research funding in all fields in Canada. The Association of Canadian Medical Colleges recognizes that the needs of medical science in respect of research are not unique, and that strong research programs are as essential for distinguished teaching in Canadian universities in most science disciplines, just as they are in the medical sciences. For this reason, it recommends that the Science Council be given this responsibility across the whole field of contemporary Canadian science.

- (4) We recommend that the senate Committee on Science Policy should propose to the Federal Government that the Association of Canadian Medical Colleges should be encouraged to be responsible for developing studies in relation to biomedical research on the following questions:
- (a) a study of the number of students enrolled in Ph.D. programs in basic science departments of Canadian medical schools to ensure the adequacy of the training base for these departments in the light of their current and projected educational responsibilities.
  - (b) an ongoing assessment of the research potential of Canadian medical schools to ensure that the Canadian Government is continuously informed of the impact of policy and budget decisions on the general level of medical research in Canada.
  - (c) an analysis of the personnel support programs adopted by

the Medical Research Council in terms of the development of Canadian medicine as a whole.

As indicated in our 1969 report, we believe that the Association of Canadian Medical Colleges has a valuable role to play in this kind of logistic research and would hope that the Senate Committee on Science Policy might endorse our efforts to obtain funding towards these and other important objectives.



STATISTICS ON SIXTEEN CANADIAN MEDICAL SCHOOLS, BY REGION  
WITH DATE OF ORGANIZATION AND ENROLMENT IN FIRST YEAR.- 1962-63 - 1974-75

TABLE I

STATISTIQUES SUR LES SEIZE FACULTES DE MEDECINE CANADIENNES  
PAR REGION, AVEC LA DATE DE LA FONDATION ET L'INSCRIPTION EN PREMIERE ANNEE, 1962-63 - 1974-75

Region and University Région et Université	Année de la fondation	Inscrits en lière année	Inscrits en lière année	% d'accroissement
	Year organ- ized	First year Enrolment	First year Enrolment	% of increase
		1962-63	1974-75	
<u>Région de l'Atlantique</u> <u>Atlantic Region</u>				
1. Dalhousie University, Faculty of Medicine, Halifax, N.S.	1867	71	97	36.6
2. Memorial University, Faculty of Medicine, St. John's, Nfld.	1967		48	
<u>Quebec</u>				
3. Faculté de médecine Université Laval, Québec	1852	133	168	26.3
4. Faculté de médecine Université de Montréal, Montréal	1843	126	205	62.7
5. McGill University, Faculty of Medicine, Montréal,	1829	112	162	44.6
6. Faculté de médecine Université de Sherbrooke, Sherbrooke	1961		100	
<u>Ontario</u>				
7. University of Ottawa, Faculty of Medicine, Ottawa	1945	71	84	18.3
8. Queen's University, Faculty of Medicine, Kingston	1854	59	75	27.1
9. University of Toronto, Faculty of Medicine, Toronto	1843	175	243	38.9
10. University of Western Ontario Faculty of Medicine, London	1881	60	106	76.7
11. McMaster University, Faculty of Medicine, Hamilton	1965		81	
<u>Prairies Region</u> <u>Région des Prairies</u>				
12. University of Manitoba, Faculty of Medicine, Winnipeg	1883	70	100	42.9
13. University of Saskatchewan, College of Medicine, Saskatoon	1926	40	61	52.5
14. University of Alberta, Faculty of Medicine, Edmonton	1913	78	118	51.3
15. University of Calgary, Faculty of Medicine, Calgary	1967		64	
<u>Pacific Region</u> <u>Région du Pacifique</u>				
16. University of British Columbia, School of Medicine, Vancouver	1949	62	80	29.0
TOTAL		1 057	1 792	69.5

Prepared by A.C.M.C. Research Section

TABLER II  
ESTIMATION DE LA CHARGE TOTALE D'ENSEIGNEMENT DES FACULTES DE MEDECINE  
ESTIMATED TOTAL TEACHING RESPONSIBILITIES OF MEDICAL SCHOOL FACULTIES - 1974-75

No	Faculté/ School	Medical Students/ Etudiants en Médecine	Internes/ Residents	Masters - Basic Science/ Maîtrise - Sciences Fondamentales	Doctoral - Basic Science/ Doctorat - Sciences Fondamentales	Post-doctoral - Basic Science/ Postdoctorat - Sciences Fondamentales	Total of Columns 4,5,6/ Nombre des autres étudiants/ Other Medical Students/ Autres Etudiants en Médecine	Total Excluding Columns 7 and 8 Total excluant colonnes 7 et 8	1973-74	Change/ Changement			
1	University of Alberta	452	64	191	17	42 Not av.	59	384	62	828	844	-16	
2	University of Calgary	186*	22	102	19	11 Not av.	30			340	387	-47	
3	University of British Columbia	322	94	258	88	32	20	140	2791	1187	2001	1344	4657
4	University of Manitoba	377	73	220	41	44	15	100	716	37.1	807.1	825	-17.9
5	Memorial University of Nfld.	218	56	60	12	11	10	33	10	.364	367.4	330	+37.4
6	Dalhousie University	373	133	222	22	18	6	46	470	100	874	902	-28
7	McMaster University	238*	67	254	58	28 Not av.	86	730	18.3	663.3	603	+60.3	
8	Queen's University	287	37	163	33	16 Not av.	49	1043	521.5	1057.5	1018	+39.5	
9	Université d'Ottawa	327	49	232.5	16	33 Not av.	49	82	19	676.5	690	-13.5	
10	University of Western Ontario	396	79	258.5	72	59	17	148	3188	445	1326.5	1168	+158.5
11	University of Toronto	980	241	835	107	90 Not av.	197	2847	517	2770	2949	-179	
12	McGill University	609	230	892	92	79	38	209	2570	85.6	2025.6	2056	-30.4
13	Université de Montréal	948	178	486	189	69	15	273	1990	350	2235	2159	+76
14	Université Laval	680	148	248	59	44	3	106	674	238	1420	1177	+243
15	Université de Sherbrooke	323	29	121	38	23		61			534	537	-3
16	University of Saskatchewan	313	55	104	17	7	10	34	2025	244	750	692	+58

TOTAL

7022 1555 4517 880 589 128 1597 19520 3824.9 18517.9 17680 44.7

\* Actual figures. See 1 in table 4-4/Nombre réel. Voir 1 tableau 4-4

\*\* Not available

Prepared by A.C.M.C. Research Section

TABLE III

Breakdown of expenditures during 1973-74 by 81 randomly selected MRC grantees and extrapolation based on the actual total expenditures for all MRC operating grants in 1973-74

Category	Total expenditures by 81 MRC grantees during 1973-74	% of grand total	Average operating grant	Extrapolation based on actual total expenditure for MRC operating grants in 1973-74
Personnel	\$1,025,347	56.53	\$12,659	\$13,835,472
Equipment	166,919	9.20	2,061	2,251,660
Laboratory animals	138,337	7.63	1,708	1,867,409
Laboratory supplies	438,020	24.15	5,408	5,910,608
Travel	<u>45,125</u>	<u>2.49</u>	<u>557</u>	<u>609,417</u>
Grand Total	1,813,748	100.00	22,393	24,474,566 *

\* Actual total expenditures for MRC operating grants in 1973-74, excluding major equipment and maintenance grants. Based on an average operating grant of \$22,393, there should have been 1,093 operating grants; the actual total number was 1,271.

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TABLE IV

Breakdown of expenditures during 1973-74 for personnel by 81 randomly selected MRC grantees and extrapolation based on the total expenditures for personnel under all MRC operating grants in 1973-74

Type of Personnel	Total expenditures by 81 MRC grantees for salaries during 1973-74	% of grand total for salaries	% of total expenditures by 81 MRC grantees for all categories (\$1,813,748)	Number of personnel	Average salary	Extrapolation based on total expenditures of \$13,835,472 for salaries under MRC operating grants in 1973-74	
						Total salaries	Number personnel
Professional assistants	\$79,498	7.75	4.38	7.3	\$10,890	\$1,072,249	98 <sup>¶</sup>
Postdoctoral trainees	48,107	4.69	2.65	6	8,018	648,884	81 <sup>¶</sup>
Graduate students	56,693	5.53	3.13	17.5	3,240	765,102	236 <sup>¶</sup>
Summer students	23,793	2.32	1.31	23	1,034	320,983	310
Technicians	748,545	73.00	41.27	114	7,170 <sup>†</sup>	10,099,894	1,409
Others *	24,744	2.41	1.36	22	1,125	333,435	296
Fringe benefits <sup>‡</sup>	<u>43,967</u>	<u>4.29</u>	<u>2.42</u>	81	543	<u>593,542</u>	<u>1,094<sup>¶</sup></u>
Grand Total	1,025,347	99.99 <sup>§</sup>	56.52 <sup>§</sup>			13,834,089 <sup>§</sup>	2,430

\* Dishwasher, animal caretaker, engineer, nurse, secretary, speaker.

† In a few instances, fringe benefits were included in the salaries.

‡ Based on the equivalent of 104.4 full-time technicians.

§ Columns do not add up to the total figures because of rounding off.

¶ Excluded from the grand total; this represents the total number of operating grants as calculated from the average fringe benefits.

¶ In 1973-74, 100 professional assistants, 79 postdoctoral trainees, and 343 graduate students were employed under MRC operating grants.

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TABLE V

Breakdown of expenditures during 1973-74 for laboratory supplies by 81 randomly selected MRC grantees and extrapolation based on the total expenditures for laboratory supplies under all MRC operating grants in 1973-74

Laboratory item	Total expenditures by 81 MRC grantees for laboratory supplies during 1973-74	% of grand total for supplies	% of total expenditures by 81 MRC grantees for all categories (\$1,813,748)	Extrapolation based on total expenditures of \$5,910,608 for supplies under MRC operating grants in 1973-74
Chemicals	\$135,527	30.94	7.47	\$1,828,742
Radioisotopes	45,877	10.47	2.53	618,841
Glassware	42,672	9.74	2.35	575,693
Plastic ware	17,744	4.05	0.93	239,380
Surgical instruments and supplies	17,157	3.92	0.95	231,696
Drugs	4,389	1.00	0.24	59,106
Photographic supplies	15,171	3.46	0.84	204,507
Electronic supplies	17,728	4.05	0.98	239,380
Publishing costs and reprints	20,053	4.58	1.11	270,706
Computer costs	15,963	3.64	0.88	215,146
Maintenance contracts	13,872	3.17	0.76	187,366
University services	21,784	4.97	1.20	293,757
Others	70,083	16.00	3.86	945,697
Grand Total	438,020	99.99 *	24.15	5,910,017 *

\* Columns do not add up to the total figures because of rounding off.

Prepared by A.C.M.C. Research Section

TABLE VI

Relationship between cost indices and 1973-74 MRC operating grants

Category	Expenditures for all MRC operating grants in 1973-74 (from Table I)	Cost index (% increase)	Dollar increase	Total
Personnel	\$13,835,472	14.6*	\$2,019,979	\$15,855,451
Equipment	2,251,660	21.3†	479,604	2,731,264
Laboratory animals	1,867,409	10.0‡	186,741	2,054,150
Laboratory supplies	5,910,608	23.6§	1,394,903	7,305,511
Travel	609,417	10.7†	65,208	674,625
Grand Total	24,474,566	16.9	4,146,435	28,621,001

\* See Table V.

† Source, Statistics Canada.

‡ Based on information obtained from universities and Canadian Council on Animal Care.

§ See Table VI.

Prepared by A.C.M.C. Research Section

TABLE VII

Relationship between cost indices and expenditures for laboratory supplies under 1973-74 MRC operating grants

Laboratory Item	Expenditures for supplies under all MRC operating grants in 1973-74 (from Table III)	Cost index (% increase)	Dollar increase	Total
<b>Chemicals</b>	\$1,828,742	35.2 *	\$643,717	\$2,472,459
Radioisotopes	618,841	35.2 *	217,832	836,673
Glassware	575,693	19.2 *	110,533	686,226
Plastic ware	239,380	43.1 *	103,173	342,553
Surgical instruments and supplies	231,696	15.8 *	36,608	268,304
<b>Drugs</b>	59,106	6.0 *	3,546	62,652
Photographic supplies	204,507	21.3 *	43,560	248,067
Electronic supplies	239,380	21.3 *	50,988	290,368
Publishing costs and reprints	270,706	---	---	270,706
<b>Computer costs</b>	215,146	---	---	215,146
Maintenance contracts	187,366	17.6 *	32,976	220,342
University services	293,757	12.4 *	36,426	330,183
Others	945,697	12.4 *	117,266	1,062,963
<b>Grand Total</b>	5,910,017	23.6	1,396,625	7,306,642

\* Source, Statistics Canada.

Prepared by A.C.M.C. Research Section

TABLE VIII

Relationship between cost indices and expenditures for personnel under 1973-74 MRC operating grants

Type of personnel	Expenditures for salaries under all MRC operating grants in 1973-74 (from Table II)	Cost index (% increase)	Dollar increase	Total
Professional assistants	\$1,072,249	21.4 *	\$229,461	\$1,301,710
Postdoctoral trainees	648,884	9.9 *	64,240	713,124
Graduate students	765,102	11.1 *	84,926	850,028
Summer students	320,983	---	---	320,983
Technicians	10,099,894	14.9 †	1,504,884	11,604,778
Others	333,435	15.5 †	51,682	385,117
Fringe benefits	593,542	14.5	86,064	679,606
Grand Total	13,834,089	14.6	2,021,257	15,855,346

\* Source, MRC.

† Information obtained by A.C.M.C. from 12 medical schools, weighted according to the MRC grants at each institution.

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TABLE IXMRC - CRM

Code Designation of Medical School	1972-73	1973-74	%	1974-75	%
1	815 847	802 579	-1.6	678 896	-15.4
2	908 068	1 006 300	10.8	1 201 225	19.4
3	1 331 191	1 446 815	8.7	1 357 087	- 6.2
4	5 839 279	6 197 697	6.1	6 472 004	4.4
5	1 021 797	1 283 629	25.6	1 011 228	-21.2
6	4 798 260	5 256 402	9.5	4 914 894	- 6.5
7	1 709 354	2 040 066	19.3	1 882 708	- 7.7
8	1 213 019	1 385 186	14.2	1 522 876	9.9
9	1 981 593	2 227 046	12.4	1 963 906	-11.8
10	1 465 177	1 524 289	4.0	2 748 536	80.3
11	392 240	385 542	-1.7	346 568	-10.1
12	3 710 166	3 573 061	-3.7	3 725 535	4.3
13	278 630	336 334	20.7	273 158	-18.8
14	706 067	890 260	26.1	1 162 775	30.6
15	2 157 695 *	2 160 038	0.1	2 170 176	0.5
16	893 405*	777 780*	-12.9	966 153	24.2
Totals	29 221 788	31 293 024	7.	32 397 725	
Average	1 826 362	1 995 814		2 024 857(16)	
S.D.	1 601 524	1 687 033		1 704 013	

\* Estimations only

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TABLE X  
CANADIAN MEDICAL SCHOOLS - FACULTES DE MEDECINE CANADIENNES

Code Designation of Medical School	Total Research Financing - Financement total de la recherche		Toutes Origines	
	All Sources			
	1973-74 -- \$ --	% of Total	1974-75 -- \$ --	% of Total
1	2 092 665	3.4	1 628 581	2.4
2	1 886 936	3.1	1 802 395	2.7
3	2 753 591	4.5	3 338 424	5.0
4	9 581 440	15.5	11 330 715	17.0
5	2 583 619	4.2	2 778 235	4.2
6	12 831 997	20.8	12 630 010	18.9
7	4 360 080	7.1	3 901 695	5.8
8	2 694 832	4.4	2 310 860	3.5
9	4 071 345	6.6	3 948 508	5.9
10	2 509 407	4.1	4 250 857	6.4
11	900 859	1.5	710 673	1.1
12	5 857 919	9.5	6 471 373	9.7
13	842 064	1.4	923 952	1.4
14	1 528 364	2.5	1 993 785	3.0
15	5 425 478	8.8	5 724 977	8.6
16	1 754 402**	2.8	2 960 427	4.4
Average	3 854 687		4 169 091	
S.D.	3 273 676		3 440 363	
Canada	61 674 998		66 705 467	

\*\* Not received for 1971-72 to 1973-74

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TABLE XI

PMB, DÉPENSES SECTEUR PUBLIC POUR AIDE EXTÉRIEURE, RECHERCHE NUCLÉAIRE ET SANTÉ PUBLIQUE  
GNP AND FEDERAL SPENDING FOR FOREIGN AID, NUCLEAR RESEARCH AND HEALTH

ANNÉE YEAR	PRODUIT NATIONAL BRUT GDP <sup>1,2</sup>		DÉPENSES POUR AIDE EXTÉRIEURE FOREIGN AID <sup>3</sup>		DÉPENSES POUR RECHERCHE NUCLÉAIRE NUCLEAR RESEARCH <sup>4</sup>		RECHERCHE MÉDICALE HEALTH RESEARCH <sup>5</sup>		ORGANISATION DES SOINS HEALTH CARE <sup>5</sup>		HABITUDES DE VIE LIFE STYLE <sup>5</sup>		ENVIRONNEMENT <sup>5</sup> ENVIRONMENT <sup>5</sup>	
	Milliards Billions	Per Capita	\$ M	Per Capita	\$ M	Per Capita	\$ M	Per Capita	\$ M	Per Capita	\$ M	Per Capita	\$ M	Per Capita
1970-71	85.5	4 112	317.9	14.87	79.4	3.71	34.4	1.61	1 552.1	72.60	12.7	.59	24.2	1.13
1971-72	93.0	4 316	342.8	15.81	76.1	3.50	36.1	1.66	1 903.2	87.78	23.3	1.07	26.3	1.21
1972-73	103.	4 739	400.2	18.34	81.6	3.73	38.1	1.75	2 095.5	96.03	23.9	1.32	34.9	1.60
1973-74	118.8	5 371	448.6	20.30	92.0	4.16	41.0	1.85	2 320.4	105.01	45.4	2.05	38.4	1.74

Sources 1 - BFS: Canadian Statistical Review no 11, 505, 1972

BFS: no 13-001 (1972)

2 - BFS: no 11-003 and 11505

3 - Annual Report CIDA (Loans and Advances have been subtracted)

4 - BFS: no 13-202

5 - New perspective on the Health of Canadians

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TABLE XIIRICHEST COUNTRIES OF OECD JUDGED BY THE GDP<sup>1</sup> PER HEAD 1971<sup>2</sup>

	Rank (R and D) <sup>3</sup>	Rank (Basic research) <sup>3</sup>
1 - U.S. 5130	1	3
2 - Sweden 4410	n.a. <sup>4</sup>	+
3 - Canada 4340	7	6
4 - Switzerland 3780	n.a	-
5 - Germany 3550	5	4
6 - Norway 3350	9	9
7 - Luxemburg 3180	n.a	-
8 - France 3180	4	5
9 - Australia 3170	n.a	-
10 - Belgium 2980	8	4
11 - Iceland 2980	n.a	-
12 - Netherland 2820	2	1
13 - Finland 2450	n.a	-
14 - United Kingdom 2430	3	7
15 - Austria 2210	n.a	-
16 - Japan 2150	5	2
17 - Italy 1880	10	8

1 - GDP: Gross Domestic Product

2 - Source: OECD Economic Surveys: Canada December 1973

3 - Source: Report no 18 Science Council of Canada

4 - N.a: Not available

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TABLE XIII  
CANADIAN RESEARCH DEVELOPMENT

TOTALS ( In millions)		Per Capita(In dollars)	
GNP 103 407		4250.00	
R and D 640.9 (0.62% of GNP)		29.27	
Ministries and Government Agencies		% of R and D	
NRC	115.6	5.28	18%
Commerce and Industry	100.2	4.58	16
Environment	96.9	4.42	15
Agriculture	67.0	3.06	10
Atomic Energy	65.5	2.99	10
National Defense	52.9	2.42	8
MRC	36.1	1.65	6
Energy, Mines and Resources	31.9	1.46	5
Health and Welfare	26.8	1.22	4
Communications	23.5	1.07	4
Others	24.5	1.12	4
Health Research (MRC, H and W, DRB, NRC)		63.2 millions	10
(0.06% of GNP Compared to 0.08 in 1970)			

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TABLE XIV  
FINANCING OF HEALTH RESEARCH IN CANADIAN MEDICAL SCHOOLS  
FINANCEMENT DE LA RECHERCHE BIOMEDICALE DANS LES FACULTES DE MEDECINE DU CANADA

BY SOURCES - SELON LES SOURCES		1973-74	1974-75	% increase/d'accroissement
Federal Sources (Government)				
MRC	\$31 293 024.	\$32 397 725.		3.5
NRC	383 906.	255 481.		-33.5
NHW	5 435 155.	5 721 624.		5.3
DRB	253 600.	238 236.		-6.0
Sub Total	\$37 365 685.	\$38 613 066.		3.3
National Sources (Non Government)				
Cancer	\$ 3 177 911.	\$ 3 828 692.		20.4
Heart Fund.	2 877 827.	2 561 467.		-11.0
Others, National	6 281 654.	5 883 925.		- 6.3
Sub Total	\$12 337 392.	\$12 274 084.		- 0.5
Provincial	\$ 5 760 568.	\$ 7 715 710.		34.0
Local	2 788 911.	4 445 584.		59.4
U.S.	2 081 348.	2 239 129.		7.6
Other Countries	22 340.	51 300.		129.6
Non Identified	1 317 534.	1 366 594.		3.7
Sub Total	\$11 970 701.	\$15 818 317.		32.1
TOTAL	\$61 663 778.	\$66 705 467		8.3

Sources: - Medical Schools and ACMC/AFMC Data Bank.  
Facultés de médecine et ACMC/AFMC Banque des données.

Prepared by A.C.M.C. Research Section

This report has been prepared by the Committee on Research and Graduate Studies of the Association of Canadian Medical Colleges. The members are:

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Appendix "45"

NOTES FOR SEPTEMBER 8, 1976 PRESENTATION TO:  
SPECIAL SENATE COMMITTEE ON SCIENCE POLICY

By

David Z. Levine, M.D., C.S.P.Q.  
Associate Professor  
University of Ottawa Medical School,  
Ottawa, Ontario.

Dr. Levine is a member of the delegation of  
Association of Canadian Medical Colleges.



Mr. Chairman, distinguished Senators and members of the audience:

My name is David Levine; I am an Associate Professor of Medicine and Physiology at the University of Ottawa, and I am on active staff of the Ottawa General Hospital. I am involved in teaching, administration, and patient care. My main efforts, however, are devoted to research in kidney disorders which is also my clinical specialty.

I am grateful for this opportunity to comment on the role of medical research in Canadian medical schools. I will not review the arguments contained in our ACMC Brief or those of my colleagues presented on the 18th and 20th of May, 1976, before the House of Commons Standing Committee on Health, Welfare and Social Affairs. My purpose this morning will be to offer some examples of essential medical school activities which are dependent upon medical research. By reviewing these examples, I hope to convey to you the importance of medical research from a more immediate perspective.

The four examples I will relate are first, the use of blood products in the application of new knowledge to patient-care, second, the introduction of an instructional programme in computer assisted training of medical students, third, the contribution of Canadian biomedical science to the development of the polio vaccine, and fourth, the activities of one group

of investigators who easily move from basic to the most "targeted" research.

Now for the first example. I have asked Dr. R.K. Smiley, Professor and Chairman of the Department of Medicine of the University of Ottawa to outline for me two areas of research with which he has been involved and which have had a significant effect on health care in Canada.

Mr. Chairman, the following words are those of Dr. Smiley: "The first area has to do with the hereditary bleeding disorder, hemophilia. There are an estimated 2400 affected individuals in Canada; the severely affected individuals were unable to attend school because of painful bleeding, they spent as much as 1/4 of their lives hospitalized, and usually died from bleeding by the age of 30 or 40. By 1965, medical research had established that these people lacked a minute amount of protein activity present in the plasma of normal individuals. However, attempts to give the patients this material from normal individuals was not very effective because such large amounts of plasma were required. In 1965,<sup>1</sup> the late Dr. Judith Pool of UCLA devised a simple method by which the protein in normal plasma could be precipitated in the cold i.e. "cryoprecipitated". It then became possible to give these patients large amounts of the missing protein in a small volume, and thus stop bleeding, or make a surgical procedure safe. My own group had noted that hemophiliacs varied in severity, and reasoned that it should be

possible to administer cryoprecipitate in small amounts daily to severe hemophiliacs and "convert them" to mild hemophiliacs, capable of going to school, working - and staying out of hospital. This proved to be possible, so that now nearly every centre in Canada has a program of home administration (of Cryoprecipitate or more recently developed dried concentrates). These developments have transformed the lives of these patients - and incidentally have saved uncounted days of hospitalization. The economic advantage of home programs are discussed in our 1967 paper.<sup>2</sup>

"The second area about which you inquired was the introduction of "frozen blood" i.e. the longterm preservation of human red cells in the frozen state. Research workers in England had shown that sperm could be successfully frozen<sup>3</sup> in 1949, and in 1950, significant numbers of red blood cells were recovered intact using the same technic<sup>4</sup>. Based on such experiments, a group of research workers in Boston devised a method to freeze whole units of blood<sup>5</sup> and showed that such blood, stored for periods of years, could be reconstituted and used safely and effectively in patients. In 1963<sup>6</sup> a much simpler method was devised to process the red blood cells into and out of the frozen state. In Canada, this technic was adopted and developed at the National Defence Medical Centre under my direction with the support of a National Health Grant in 1963.<sup>7</sup> Since that time the "frozen blood bank" has developed a collection of rare blood

types, which have been supplied to patients in Canada, as well as a number of other countries. The operation has become a part of the Red Cross National Transfusion Service, and facilities to store and reconstitute blood from the frozen state are being established at depots across Canada. An interesting and valuable "fringe benefit" of this developmental research was the involvement of Dr. Roger Perrault, at that time a new medical graduate, who is now National Director of the Canadian Red Cross Blood Transfusion Service."

My second example relates to the research component of the training of medical students to become doctors.<sup>8</sup> For this I will describe the introduction of computer-aided instruction at the Ottawa General Hospital. This, and other computer techniques, are believed to be useful. While there is an innovative character to this teaching method, other curriculum changes less involved with technology, may be equally innovative. I focus attention on computer-aided instruction because it is something with which I have had experience and it has helped me see some issues regarding the role of medical research in education which I would now like to share with you.

First, a description of what the medical student experiences. This programme was designed to assist in the teaching of acid-base and electrolyte disorders to medical students and house-staff. A typewriter-style computer terminal is located one floor below the teaching ward of the hospital. It allows the students to



communicate with the computer on campus by means of the dial telephone attached to the terminal. Within five minutes of leaving the bedside of his patient, the student usually can have, in hand, a typed print-out which contains an evaluation note. This evaluation refers to data from the patient whom the student is following on a daily basis. The evaluation includes diagnostic possibilities, discussion of the mechanisms of the observed disturbances, and appropriate references to the literature.

What has all of this to do with medical research?

Dr. Howard L. Bleich of the Harvard Medical School invented this programme. He had already carried out investigations in fluid and electrolyte disturbances before he began his more recent research in medical information systems. There is no doubt that the mastery of the medical science required to write this complex programme is more readily available to one who has carried out research in that area.

I know it is only because my training was similar to that of Dr. Bleich, that I felt competent to introduce this technique in our medical school. You see, research in my laboratory is focussed on areas that concern the computer programme. My research involves the effects of disturbances in body potassium, blood gases, the mechanism of action of diuretics -- to name only a few examples. This work prepares

me for the answer to the most important question a medical student or a colleague can ask. The question is, "How do you know what the computer says is true?". My answer is generally the same: "I don't really know it's true but it's the best opinion we can formulate if we consider data from the following research projects." Then I tried to relate the scientific basis for the particular computer response to the patients' data entered into the terminal by the medical student.

To be sure, if I can justify the scientific basis for a computer response to a given problem, then presumably I can justify my own response to a given patient as well. There is no difference.

What we teach our medical students, Mr. Chairman, is medical science and a scientific approach to understanding disease. When medical research is vigorous, the teaching of dogma becomes less likely. When research in a medical school is active, even in fields vastly removed from the problems of an individual patient, a scientific approach to that patient, although not guaranteed, is more likely. You have heard before that the clinician and the medical researcher have much in common. Both must make accurate observations and then carefully scrutinize the so-called facts they gather. Both clinician and investigator must be familiar with the medical literature and must be able to recognize its limitations. Both must,

in the end, arrive at reasonable conclusions which are dictated by the facts and not by convention, whims or prejudice.

Using this example of computer-aided instruction, I have tried to indicate some of the relationships between medical research and medical education. I have not referred to other issues because, you have already heard them. These include the observations that highly rated medical schools have strong research programmes, and that outstanding physician-teachers seek out those schools with vigorous research activity.

The third example concerns the development of polio virus vaccine. To relate the Canadian contribution to this important medical advance, I asked Professor J. Gordin Kaplan to help me. He is Chairman of the Department of Biology and past Chairman of the Canadian Federation of Biological Societies. Dr. Kaplan refers to the work done in the late forties and early fifties at the University of Toronto by Dr. Ray Parker, Dr. Joe Morgan, and Dr. Helen Morton. The following words are those of Dr. Kaplan:

"They were trying to develop a medium in which a variety of mammalian cells could grow in tissue culture. After many efforts of trial and error, they developed a culture medium which they called Medium 199, in which certain mammalian cells, like monkey kidney cells which were difficult to

propagate outside the body of the animal, could grow quite well. Indeed, Medium 199 is still probably the most widely used tissue culture medium at the present time and is commercially available from a number of firms; we still use it extensively in my laboratory. "

" It thus had a wide impact on a variety of studies dealing with the control of growth, cancer and virus propagation. Among those who used it was Dr. Thomas Enders of Boston, who with his colleagues had been looking in the late forties and early fifties for a method of propagating the virus of human poliomyelitis in order to utilize the large amount of virus which this would permit in order to develop a vaccine. Enders knew from experiments with living animals that the human polio virus would grow well in monkey kidneys. Hearing of the work of Parker, Morgan and Morton, he soon developed a system in which the monkey kidney cells growing in Medium 199 became the hosts for the rapidly multiplying polio virus. This was the key discovery making possible the eradication of poliomyelitis by subsequent development of a vaccine; this was recognized by the award of the Nobel Prize in Medicine or Physiology to Dr. Enders and his two associates. This critical work could not have occurred without the previous discovery of the Toronto group."

Mr. Chairman, by use of this third example, I hope to underscore the fact that medical schools are part of universities and it is the sacred trust of Canadian universities and medical



schools to provide new knowledge for the benefit of all.

We have seen examples of basic research and applied research in Canadian medical schools. I would now like to offer the last example which elegantly demonstrates that Canadians can carry out excellent medical research which is, in the same setting, very basic and very applied. I now refer to the work of Dr. Charles Scriver and his colleagues in Montreal.<sup>9-13</sup> I thought it would be best if Dr. Scriver tells the story himself. He responds as follows to my request:

"You have asked for an example in the area of genetics where basic research has paid off in terms of Canadian health care. There are many examples in genetics but I have taken your guidance and picked the Canadian example which has many facets of interest. The theme concerns basic research on membrane transport. The application is treatment of metabolic bone disease. My interest in membrane transport led us to set up a screening programme to identify disorders of tubular reabsorption of amino acids in patients. This led to the discovery of a group of patients with a generalized disorder of tubular function ultimately traced down to Vitamin D deficiency. The source of the Vitamin D deficiency was then identified and by changing the regulation affecting the Vitamin D content of fluid milk sold in Quebec we have virtually eradicated this medical problem which was costing approximately half a million dollars per year 1970 medical

costs. An additional comment about this particular episode is that basic research devoted to the study of amino acid transport led to a discovery of a major clinical disorder affecting phosphorus. There is no correlation between the two but the emphasis and the non-directional input into a basic research programme had a pay-off in terms of targeted research in a totally different area."

"The second example concerns phosphate and X-linked hypophosphatemia. X-lined hypophosphatemia is a classic disease originally described in 1937. The classical view considers this to be a disorder of Vitamin D metabolism and the responsiveness of tissues to Vitamin D. We adopted a different view. Our knowledge of membrane transport of water soluble substances, in particular amino acids, had led us to the view that cellular membranes contained mechanisms under specific genetic control which allow each substance and fuel to enter the cell by its own carrier system. It was a simple but basic assumption to argue that classical hereditary Vitamin D resistant ricketts could in fact be a genetic disorder of phosphate transport. We initiated basic studies of phosphate transport in man and determined that a specific phosphate transport defect appeared to exist in the hereditary Vitamin D resistant form of ricketts. Since Vitamin D is not known to have a direct effect on phosphate transport in kidney, we then argued that there was no specific rationale for treating

patients with Vitamin D primarily. Accordingly, we carried out an extensive research evaluation of phosphate replacement therapy as a specific means of neutralizing the effect of the mutant gene. We found that phosphate radically improved the treatment of these patients. The impact of this research has been twofold. Firstly, medical admissions for these patients to our hospital have been virtually eliminated. The cost of care for these patients has been reduced: approximately 200 days per year were required for such admissions in our hospital. The admission rate is now less than 10% of that per year. Furthermore, these patients who were previously dwarfed and deformed are now achieving normal heights with minimal deformities. The value of this result in human terms cannot be estimated by any cost accountant. Second, the results of our studies in X-linked hypophosphatemia led to the discovery of and clarified the interpretation, of yet another form of hereditary bone disease. Now it is recognized to be a prevalent form of severe chronic debilitating illness in Canadian medical centres. Once it was clear that Vitamin D deficiency (the first study mentioned above) produced a special form of tubular damage leading to ricketts and once it was clear that X-linked hypophosphatemia is an inborn error of phosphorus transport, it was possible to recognize that there was yet another form of bone disease relating to an inborn error of Vitamin D metabolism which mimics Vitamin D deficiency and which was distinct from

X-linked hypophosphatemia (see Review by Scriver and Fraser). Once these discoveries were made by Canadian investigators, it was possible to take advantage of basic research in the chemistry of Vitamin D in an American laboratory, that of Dr. DeLucas, and to develop remarkably effective treatment procedures. As a result, the medical impact of this disease has been eliminated and all patients known to us are now out of hospital and under effective medical control in the community."

"I picked these themes which embrace basic research in genetic mechanisms of disease, membrane transport biology, phosphorus and calcium metabolism and Vitamin D chemistry because major Canadian contributions in the first three of these four areas have "revolutionized" thinking about classical medical problems and indeed led to the discovery of a new disease. These advances have changed the medical treatment first in Canada and now slowly in American medical centres and European medical centres and elsewhere in the world for these groups of patients."

"Finally, there has been an additional and very important yield which should not be ignored. Dr. F. Glorieux worked with me on X-linked hypophosphatemia when he was doing his Ph.D. This particular project led Dr. Glorieux into his career. He is now the Director of the Genetics Unit of the Shriners Hospital in Montreal. This is the first Shriners



unit in the world and its development was directly related to the success of Dr. Glorieux's graduate studies at this university. "

"I think these examples illustrate in an effective way how university-based basic research yields unpredicted but great benefits for patient care not only in Canada but elsewhere in the world."

Mr. Chairman, in reviewing these different examples of medical school activities, the Committee will have noticed that one faculty member often wears different hats. I indicated at the outset that I had teaching responsibilities and patient care responsibilities in addition to conducting laboratory research. Dr. Smiley is Professor and Chairman of the Department of Medicine at the University of Ottawa and while carrying out the work on frozen blood and cryoprecipitate he was deeply immersed in patient care and the training of medical students. Dr. Scriver and his colleagues in Montreal conduct, simultaneously, research projects which are both basic and applied. While doing so, they care for sick children and teach medical students. Accordingly, it must be clear that faculty members in medical schools in Canada are challenged with several duties. They are often basic scientists and applied scientists; they are the introducers of modern techniques

of health care delivery, and expert teachers. If you wish to rigorously separate teaching from patient care, or patient care from applied research, or applied research from basic research, you will find it impossible. I believe this phenomenon of "unimposed overlap" gives our medical science its strength. It ensures that patient care is modern and scientific, that medical education is up-to-date and factual and that investigation is carried out in a milieu where basic and applied medical research make their necessary contributions.

In summary, Mr. Chairman, I have tried to convey with my colleagues' help, the dependence of medical school activities on research. I hope that these specific examples will help the Committee to evaluate more general arguments which they have heard. I would be pleased if the Committee could join me in the belief that the contribution Canadians expect from their health science centers can only be forthcoming if Canadian medical research is nurtured.

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FIRST SESSION—THIRTIETH PARLIAMENT  
1974-76

THE SENATE OF CANADA  
PROCEEDINGS OF THE  
SPECIAL COMMITTEE OF THE SENATE ON  
**SCIENCE POLICY**

The Honourable MAURICE LAMONTAGNE, P.C., *Chairman*

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Issue No. 24

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WEDNESDAY, SEPTEMBER 8, 1976

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Twenty-fourth Proceedings on  
the Study of Canadian Government and  
other expenditures on scientific activities  
and matters related thereto.

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(Witnesses and appendices: See Minutes of Proceedings)

THE SPECIAL COMMITTEE OF THE  
SENATE ON SCIENCE POLICY

The Honourable Maurice Lamontagne, P.C., *Chairman*

The Honourable Donald Cameron, *Deputy Chairman*

and

The Honourable Senators:

Asselin	Hastings
Bélisle	Hicks
Bell	Lang
Blois	Manning
Bonnell	Neiman
Bourget	Riel
Buckwold	Robichaud
Carter	Rowe
Giguère	Stanbury
Godfrey	Thompson
Goldenberg	van Roggen
Grosart	Yuzyk
Haig	

27 Members

(Quorum 5)

# Order of Reference

Extract from the First Report of the Special Committee of the Senate on Science Policy, presented on July 10, 1975 and printed as an Appendix to the Minutes of the Proceedings of the Senate of that day, and adopted by the Senate on July 24, 1975:

"The Committee, therefore, recommends that it be authorized to consider and report on Canadian government and other expenditures on scientific activities and matters related thereto;

That the Committee have power to engage the services of such counsel and clerical personnel as may be necessary for the purpose of the inquiry;

That the Committee have power to send for persons, papers and records, to sit during adjournments of the Senate and to report from time to time; and

That the Committee be authorized to print such papers and evidence from day to day as may be ordered by the Committee."

Robert Fortier,  
*Clerk of the Senate.*



# Minutes of Proceedings

Wednesday, September 8, 1976  
(38)

Pursuant to adjournment and notice the Special Committee of the Senate on Science Policy met this day at 2:37 p.m., the Chairman, the Honourable Senator Lamontagne, presiding.

*Present:* The Honourable Senators Bell, Carter, Godfrey, Hicks, Lamontagne, Stanbury and Yuzyk. (7)

*In attendance:* Mr. Philip J. Pocock, Director of Research and Mr. Jacques W. Ostiguy, Chief of Administration.

The Committee resumed consideration of its Order of Reference dated July 24, 1975 relating to the Study of Canadian Government and other expenditures on scientific activities and matters related thereto.

The following witnesses were heard:

*From: Canadians for Health Research:*

Mrs. Patricia Harris,  
Member of the Coordinating Executive Committee,  
and National President,  
Canadian Rehabilitation Council.

*Biological Council of Canada:*

Dr. D. F. Mettrick,  
Chairman and Professor,  
Department of Zoology,  
University of Toronto;

Dr. D. B. Walden, Past-President,  
Professor, Department of Plant Science,  
University of Western Ontario;

Professor K. G. Davey, Chairman,  
Canadian Committee of University Biology Chairmen,  
Professor and Chairman of the Department of Biology,  
York University.

*The Canadian Biochemical Society:*

Dr. J. M. Neelin, Chairman and Professor, Department  
of Biology,  
Carleton University;

Dr. David MacLennan,  
Professor at The Banting and Best Department of  
Medical Research,  
University of Toronto.

On Motion by the Honourable Senator Carter, it was Agreed that the briefs presented by the Biological Council of Canada and the Canadian Biochemical Society be printed as appendices to this day's Minutes of Proceedings and

Evidence. (See appendices Nos. "46" and "47")

Mrs. Harris, Dr. Mettrick and Dr. Neelin each made an introductory statement. The witnesses then answered questions put to them by Members of the Committee.

At 5:57 p.m., the Committee adjourned until 9:30 a.m., Thursday, September 9, 1976.

ATTEST:

Patrick Savoie,  
Clerk of the Committee.

# The Special Committee of the Senate on Science Policy

## Evidence

Ottawa, Wednesday, September 8, 1976.

The Special Committee of the Senate on Science Policy met this day at 2.37 p.m. to consider Canadian government and other expenditures on scientific activities and matters relating thereto.

**Senator Maurice Lamontagne** (*Chairman*) in the Chair.

**The Chairman:** Honourable senators, we have three groups before us this afternoon: the Canadians for Health Research, the Biological Council of Canada, and the Canadian Biochemical Society. Representing the Canadians for Health Research is Mrs. Patricia Harris, who is a member of the Coordinating Executive Committee and National President of the Canadian of the Canadian Rehabilitation Council.

To represent the Biological Council of Canada we have Dr. D. F. Mettrick, Professor and Chairman of the Department of Zoology, University of Toronto. Dr. J. M. Neelin, Chairman of the Science Policy Committee of the Canadian Federation of Biological Societies and Professor and Chairman of the Department of Biology, Carleton University, is here to represent both the Biological Council of Canada and the Canadian Biochemical Society.

We have not received any special brief from the Canadians for Health Research, but we have received briefs from both the Biological Council of Canada and the Canadian Biochemical Society. I would ask that these briefs be printed as appendices to today's proceedings. Is it agreed?

**Senator Carter:** I so move.

**Hon. Senators:** Agreed.

(*For text of briefs see Appendices, p. 29*)

**The Chairman:** I will now ask each of the main representatives of the three groups to introduce their colleagues and to make their short opening statements. We will begin with Mrs. Harris.

**Mrs. Patricia Harris, Member of the Coordinating Executive Committee, National President, Canadian Rehabilitation Council:** Thank you, Mr. Chairman. There is no one else from my group here and I should like to make it quite clear that I do not in any way represent members of the scientific community of medical research. I am one of those volunteer ladies who have been involved with a number of health oriented organizations, particularly specific disease oriented organizations, across Canada, and from that I have become involved subsequently with Canadians for Health Research. Therefore, if my paper does lack some of the more scientific terminology you have been hearing today, I hope you will understand.

**Senator Stanbury:** It will be refreshing, perhaps.

**Mrs. Harris:** Historically, the achievements of a society are remarked by gains in knowledge resulting in the solution or control of obstacles. In all facets of human existence, the hunger for knowledge and the response to challenge are our measure for progress. It is doubtful whether any true criteria could be established to grade the results of the expertise of researchers in the myriad of sciences and technology existing today within highly developed societies. Who bothers to judge: The ability to produce astro turf for the players of games, or the intricacies of new procedures to facilitate hospital laboratory tests; the ability to land on the moon, or the use of teflon for artificial heart valves; the laser beam as an instrument of war, or the laser scalpel for accurate and safe repair of a detached retina?

Emotionally, all of us can make distinctions of value. Economically, those distinctions may appear in a different light. The importance is more probably in the knowledge gained from each development. Certainly, some developments have greater impact on larger numbers of people than do others—depending on geography, economics, and even politics. As children, many recall the mystery and horror of the quarantine sign nailed to the front door of a neighbour's home, or our own. Our children have never seen such segregation. As children we knew that warts came from handling toads, or touching the hands of someone who had handled toads. Our children know that a wart is a virus. As children, we knew that a home could be heated with fire—the burning of wood, coal, sawdust, peat, gas or oil, whichever was handy or affordable. Our children, growing up in the land of frozen food, microwave ovens, vitamin supplements and booster shots, see fuel as a commodity in great shortage. The optimists, and here I am inclined to believe in middle-age optimism, are more confident that man's ingenuity will overcome this problem too.

CANADIANS FOR HEALTH RESEARCH developed from a threat to progress. We represent concerned individuals, both independently and under the aegis of voluntary and professional organizations involved in the delivery of health care. Our group originated as a result of the recent cut-backs in governmental support of research programmes, both basic and applied, in health sciences. While such cut-backs have since been modified, it is nonetheless our contention that the situation remains disquieting. The budgetary regressions in question served, in fact, to open the eyes of many to the absolute and relative position of Canada in the field of medical research.

Detailed material has already been made available to substantiate our arguments and only the fundamentals will be presented at this hearing, subsequent questioning being invited.

Research has benefits, both direct and indirect. Advances in knowledge attained by curious and thoughtful minds, obviously contribute directly to the welfare of the community, while the refusal of such invaluable investiga-

tors to take anything for granted prevents decline of medical practice into dogmatic empiricism. Failure to support research must inevitably mean a loss of rare talent from the country or, short of that extreme, from research into practice.

The concern of the public is manifest by the fact that volunteer health agencies have provided support increasing by an average of 15 per cent annually since 1971-72, during which period the budget of the Medical Research Council has declined by 10 per cent, with allowance made for inflation. Another comparison is that this decline occurred while the gross national product value, similarly adjusted, increased some 25 per cent.

Although on a per capita basis Canada has a gross national product comparable with that of the United States, in 1975 our budget for medical research was less than 1/6th that of our neighbour, again on a per capita basis. While the private sector does provide a significant 20 per cent of the funds available, the 80 per cent depended upon from government sources represents the dominant influence.

In comparison with other countries of the developed world, Canada does not make a good showing in this regard, and yet several of the developing countries look to her for assistance. Canada ranks third in gross domestic product, behind the U.S.A. and Sweden, out of 27 richest countries, while she ranks seventh in support of research in general, behind the U.S.A., Netherlands, U.K., France, Germany and Japan, with net support continuing to decrease. It is not acceptable, for cogent reasons which have been defined, to take the attitude that we can leave research to others and benefit from their advances; such an attitude would be irresponsible because it fails, among other reasons, to take into account the contributions which Canadian scientists have made in the past.

Research is not something that can be turned on and off like water from a tap. It takes time to recruit the necessary personnel—medical, scientific and technological; it takes more time for them to acquire the necessary experience and expertise. Once a trained person is lost from research, the loss is likely to be permanent. In this context, we ask you to consider the hard fact that, in the past 3 successive years, the number, in round figures, of MRC grant-holders has dropped from 1,500 through 1,200 to 1,000. This decline, symptomatic of what we should consider a national malady, must be reversed. We again thank the government for having increased the MRC budget by \$2 million in mid-May, which allowed for some repairs to be made in the March grants competition. However, as this falls short of the \$6.6 million "decrease" caused by the December 1975 freeze on MRC's budget, we urge the Government to provide MRC with an additional immediate supplement of \$4.6 million.

I will give you a quotation which I think could well have been the inspiration for the founding of Canadians for Health Research:

Unless the societies of tomorrow want to suffer from a widening technological gap or to be dominated by technology, they will have to devote much more serious and continuing attention to their overall science effort than they have done up to now . . . This vigilance is a responsibility that belongs to all individuals and groups.

This is from the report of the Senate Special Committee on Science Policy, Vol. I, Chapter 1.

Thank you.

**The Chairman:** Thank you very much, Mrs. Harris. We have a problem this afternoon again in that the two other presentations which are about to follow represent a rather different area of interest and concern. I was wondering, since we have adjourned our meeting with the Medical Research Council because we did not have time this morning properly to cover the ground insofar as the council was concerned, if you would be able to come back, as the council agreed to do, later in the year, possibly in November, so that we might be in a better position at that time to deal with your statement and your area of concern. If that were to be done, we would concentrate on the two other organizations this afternoon. Would it represent a great inconvenience to you to come back to Ottawa?

**Mrs. Harris:** No, it would be a pleasure.

**The Chairman:** I do not want to speak for my colleagues, but if we could concentrate this afternoon on the two other briefs, and postpone that of Mrs. Harris, it would be better. Senator Stanbury is free to ask questions of Mrs. Harris, of course, but since we have less than three hours, we should try to concentrate on the two others for this afternoon.

Would you proceed with your opening, Dr. Mettrick?

**Dr. D. F. Mettrick, Professor and Chairman, Department of Zoology, University of Toronto, Biological Council of Canada:** Mr. Chairman and honourable senators, may I first introduce two colleagues who are with me this afternoon? First is Professor K. G. Davey, Chairman of the Canadian Committee of University Biology Chairmen and professor and chairman of the Department of Biology, York University. Next to him is Dr. D. B. Walden, past-president and professor, Department of Plant Science, University of Western Ontario, and past-president of the Biological Council of Canada.

I would like to begin this presentation by briefly explaining our mandate to appear before you this afternoon.

The Biological Council of Canada is one of two umbrella-like organizations, the other being the Canadian Federation of Biological Societies. Together we represent some 20 scientific societies and over 7,000 Canadian biologists.

The Canadian Committee of University Biology Chairmen represents just under 100 university biology departments which have a collective membership of over 2,000 biologists.

The inter-relationship between these organizations is shown by the fact that I myself, for example, am president of the Biological Council of Canada, chairman of the Department of Zoology, University of Toronto, and also represent the Canadian Society of Zoologists. My colleague, Dr. Neelin, on the other hand, is past-chairman of the Science Policy Committee of the CFBS, chairman of the Department of Biology, Carleton University and is also representing the Canadian Biochemical Society.

As a group we can legitimately claim a broad mandate representing the various areas of biology from the health sciences to environmental biology.

**Mr. Chairman,** the brief that the Biological Council of Canada submitted to you earlier this year was also supported by letters from the CFBS and the CCUBC. It was a



wide-ranging brief and I do not intend to go over old ground by a detailed review of the contents of our submission. Instead, I propose only to give this afternoon a broad review, and just comment on three particular points which were covered in the brief, namely, inflation as a tool of government science policy, the role of the government science laboratories and the role of Canadian universities.

As Dean Larkin of the University of British Columbia recently observed, "I am sure there is a government policy for science in Canada, and if we could only find it we might understand it and be able to respond". I share Dean Larkin's dilemma, because from where we sit an explicit science policy is still strangely and disconcertingly absent.

At a recent meeting, June 17, between Mr. Drury, Minister of State for Science and Technology, and a small group representing university research administrators, scientists and social scientists, Mr. Drury expressly stated that it was the policy of the federal government to increase research by private enterprise, maintain the purchasing power of inhouse government research and to allow inflation to further erode the research support for the universities.

Dr. Harold Harvey, in his recent paper published in Canadian Public Policy entitled "Inflation: A powerful tool in Government Science Policy," concluded, on the basis of previous government action, that the federal government was and had been deliberately using inflation to erode the strength of university-based research. I believe that Mr. Drury's recent statement is the first time that this aspect of the government's science policy has been publicly admitted. We should like to go on record that in our opinion the government should be able to document its fundamental dissatisfaction with such a major sector of Canada's research potential as that carried out in our universities, before it so deliberately erodes and cuts university science in terms of real dollars. The universities have not received the justification to which they were entitled.

Dr. Harvey has traced the initiation by Mr. Drury of this policy of erosion, if indeed something so negative can be called a policy, to the late 1960s, prior to the earlier reports of your committee, Mr. Chairman.

I hope that the committee will accept the evidence presented in the brief that this freezing and erosion in real dollars of university scientific research funding is unique to Canada, that the absolute level of spending for university research in Canada was and is not particularly high, and that in terms of both the total federal budget and GNP, government expenditures on research and development have been falling since 1969. It is perhaps worth noting that Maurice l'Abbe, Chairman of the Canadian Association of University Research Administrators, recently documented that the Canadian government does budget more heavily for R & D in the humanities than do the governments of other countries, but I will leave that interesting aspect of federal research policy for another time.

From the point of view of biology in Canada the thing that disturbs us most over the changes in science funding during the past 6-7 years is that the reductions in R & D in terms of GNP have been *entirely* at the expense of university-based research, and that there has been a concomitant continued increase in federal in-house R & D and in total federal science expenditures. Indeed, the early 1970s, when your committee, Mr. Chairman, was calling for a halt to federal expansion in research, instead saw the construction and staffing of some of the largest federal science

laboratories, which, not by accident, were strongly biologically orientated. The Freshwater Institute, Winnipeg, and the Canada Centre for Inland Waters, Burlington, are two good examples.

Thus, as universities do less research, the federal government does more. What, Mr. Chairman, to use the vernacular, is the rationale of robbing Peter to pay Paul when Peter was and is still perfectly capable of doing much of the work now carried out by Paul? This was not a case of directing research funds from basic research to applied projects. Basic research in government laboratories continues to increase and is now nearly 20% of total intramural R & D in the natural sciences.

We are not specifically arguing that the total expenditures by the federal government in the natural sciences are dangerously low. We are most strongly saying that the distribution of these funds between the sectors involved is irrational and is causing irreparable harm to university-based research in the sciences and in biology in particular.

As far as biology is concerned the situation is further exacerbated by the very small contributions from the R & D budgets of the scientific federal departments to the university sector. The total budgets of the Departments of Agriculture, Environment, Energy, Mines and Resources are over \$400 million of which only 1.5 per cent of \$6 million is spent in the university sector. In contrast 50 per cent of the \$240 million budget of National Health and Welfare, the Medical Research Council, National Research Council and Supply and Services is spent in the university sector. We fail to see why university researchers in plant and animal sciences, forestry, environmental and population biology, to name just a few areas, cannot get support of any kind from Canada Agriculture or Environment, and have to seek aid from the NRC.

When Dr. Kell of the NRC Division of Chemistry recently wrote in *Science Forum* that the leadership in basic research in Canada will definitely move away from the universities to government research institutes, he was indeed describing one effect of the erosion of university-based research. He forgets to consider that the calibre of the leading Canadian researchers of the future will depend on the quality of their university training. This brings forth the question of whether your committee is going to recommend that the training of future Canadian scientists is also going to move to government laboratories.

That is fundamentally what is at stake, the capacity of our university bioscientist to undertake first-class research, and in the process to fire the enthusiasm of undergraduate and graduate students and ensure that Canada has a cadre of young first-class trained researchers to staff our universities, government laboratories and our growing industrial research sector.

It is our belief, as documented in the brief, that while continued strength in university research in the life sciences will be essential to Canada over the rest of this century, present government policies can result not only in a shortfall in trained personnel but that the training itself will be second-class and the product less than adequate.

Since World War II, Canada, at considerable expense, and with the enthusiastic support of former federal governments, has built up a system of university and graduate schools that can match those found anywhere else in the world. What we are now witnessing is the completely irresponsible dismantlement of this system at the whim of the present federal government.



Mr. Chairman, you have our brief. You know who we are and whom we represent. If I have to sum up this matter in a nutshell, I would ask you and your committee this question: What do you want Canadian universities to become in the next few years? Thank you.

**The Chairman:** Thank you very much. We will not answer that question this afternoon.

**Dr. J. M. Neelin, Chairman, Science Policy Committee, Canadian Federation of Biological Societies; Professor and Chairman, Department of Biology, Carleton University:** Mr. Chairman, honourable senators, we are grateful for this opportunity to present the views of Canada's biochemists on the policies which will guide the government and the application of science in this country. Dr. Rose Sheinin, now past-president of the Canadian Biochemical Society, to whom your invitation was originally addressed, regrets that she could not attend this sitting of your committee. In her stead, Dr. MacLennan and I represent the largest of the eight member societies of the Canadian Federation of Biological Societies, and we are both members of the Science Policy Committee of this organization. Dr. MacLennan is a professor in the Department of Medical Research at the University of Toronto, and I am in a biology department in the science faculty at Carleton University. Thus we may reflect the views of two constituencies of biologists, those whose research is supported by the Medical Research Council, and those who depend primarily on the National Research Council. Less directly, we also represent a large number of biochemists in government, medical institutions and industry.

The scope of biochemistry is defined for you in previous submissions. Let us only remind you that this interdisciplinary field applies the methods and concepts of chemistry and physics to the solution of biological problems at the molecular and cellular level. Much biochemical research would still be labelled "curiosity-oriented basic research." However, most Canadian biochemists are mindful of the social context of their research, and we are eager to direct our curiosity toward achieving national goals in health, agriculture, forestry, and the environment. For example, basic research on the control of cell differentiation has an important bearing on the loss of such controls in cancer cells. The understanding of mechanisms for hormonal control of plant growth aids in the selective eradication of undesirable species competing with food plants and reducing crop yields. The perception of normal metabolism of food and production of energy helps in the rational design of diets. Even though biochemical studies have made great contributions to the betterment of the human condition, much more fundamental research will have to add to our present knowledge before the discipline can make its full contribution as a mission-oriented science.

**Futures Research.** In your invitation to our society, you identified three areas of current concern to your committee. In her reply, Dr. Sheinin addressed herself to these three topics, but perhaps we can clarify or elaborate on some points.

Futures research is more the concern of demographers, economists and political scientists than of natural scientists who are accustomed to limiting their projections to the next point in an experiment. However, we would be relieved to know that our contribution to society was being designed in accord with a rational plan including expected populations, future health and food needs, predicted resources, and stated cultural goals.

The Canadian Biochemical Society welcomed many of this committee's earlier recommendations. Unfortunately, some of these recommendations were never implemented and others have been eroded or diluted in practice.

As far as we are aware, the federal government has not developed an overall plan for science and technology to which scientists and managers can adjust their aspirations and programs. Although the Canadian Institute for Scientific and Technical Information, housed at the National Research Council, now publishes annually a useful list of all research projects supported by federal agencies in universities, no such compilation is offered for in-house research. This lack increases the risk of duplication, both among government laboratories, and between them and the private sector. Despite our positions in graduate and professional schools, we are unaware of any official projection of manpower needs, other than a generally negative feedback from all sectors simultaneously. This wasteful and demoralizing process is perhaps the worst failure in governmental coordination of an important national resource in this generation.

The national expenditure on research and development declined in relation to gross national product, rather than approaching the 2.5 per cent target recommended for 1980. Presumably this committee's arbitrary recommendation that the national budget for basic research be limited to 10 per cent of the total was predicated on the overall increase which never materialized.

**The Chairman:** Not only presumably; it is certain that our proposal was based on that projection.

**Dr. Mettrick:** Indeed, industrial research in biochemistry has lost ground with the closing of several pharmaceutical research houses, while basic research has been allowed to shrink through the attrition of frozen or austere budgets. These problems are outlined in two documents, the booklet "Medical Research; The Immediate Need for Increased Funding," published in 1974, and "Tomorrow's Biology? a National Statement on Basic Biology in Canadian Universities," published in 1976.

For several years there has been only intermittent alleviation of the problems in research funding through the Medical Research Council. Each year its budget is cut below the minimum needed to fully utilize the research potential in our medical faculties. Each year the research community must be distracted from its proper concerns to alert its sympathizers in the public, and almost each year a responsive Health and Welfare Minister searches for a fraction of what is needed to hold the line. The erratic nature of such funding, the irreversible disruption of long-term projects, and the bleak prospects demoralize not only established scientists but especially the young people on whom our future capacities must depend.

Next to the social sciences, this committee recommended that the life sciences be favoured in government's priorities for support during the 1970s. "Tomorrow's Biology" demonstrates that the opposite has happened—that in order to restore an average operating and equipment grant to 1969 levels of potential productivity, the National Research Council's budgets for its four biology committees would have to be increased by \$7 million rather than by the \$700,000 which its 1976 budget permitted. The drastic economies forced once more on these committees means that biological research is operating at barely marginal levels in many institutions, and that it will take 36 years at

present rates before each current grantee can expect to acquire or replace a major piece of equipment.

The Senate committee recommended that the federal government support the full costs of research in the universities, but the opposite might be the unfortunate consequences of current renegotiations of the Fiscal Arrangements Act. Our association is on record as strongly in favour of a continued federal presence in higher education on a university-based research.

In our submission to the previous sittings of this committee, the CBS advocated the maintenance of centres of basic research in federal laboratories. One such centre has produced Canada's only living Nobel laureate, and such centres should be able to concentrate scientists from many disciplines on a single subject in a way which university departments find difficult. However, competitive mechanisms must be devised to ensure the superior quality of such groups, and there is no reason why they need be concentrated in Ottawa.

Some of the Senate committee's recommendations concerning the training of research managers and the appointment of science policy advisors has seemed to us more likely to add to the bureaucracy of science than the efficient scientific productivity. Even the creation of a ministry for science has not raised the productivity of biochemistry in government or private laboratories.

The review of science expenditures seems to be one role which the Ministry of State for Science and Technology has adopted with enthusiasm, but we feel perhaps in the negative sense of greeting submissions from scientists and their agencies with skepticism, if not suspicion. Aside from the standing Committee for Health, Welfare and Social Affairs, there is no official avenue by which scientific societies express their views directly to parliamentarians. The Senior Interministerial Committee for Science and Technology might be made accessible to the public, since so much scientific activity is conducted in private or provincial institutions. Since the Research Councils have earned our confidence as well-informed and understanding advocates of Canada's scientific needs, we would prefer to see the government's relations with the scientific societies remain in their hands. We also feel that these agencies, cooperating with the appropriate societies, have a creditable record in handling Canada's international scientific relations, and we see little reason for gambling on a disruptive change. We have found the Science Council to be cooperative in collecting data and opinions and in making them available to the public.

In closing, we should point again to one direct consequence of this committee's initiatives five years ago. The Canadian Biochemical Society, like many of its sister societies, is now deeply involved in science policy through the Canadian Federation of Biological Societies, through SCITEC, and through collaboration with the Canadian Society for Clinical Investigation, the Biological Council of Canada, and several university-based organizations. This work must be done in the spare time of our members at the expense of their research or teaching, and the cost must be borne by the fees of the membership. Most of us feel that this is a small price to pay for the future of science in this developing country.

Thank you.

**The Chairman:** Thank you very much, Senator Stanbury?

**Senator Stanbury:** Mr. Chairman, I am disappointed that you did not let Mrs. Harris and I have some fun, because I had prepared some interesting questions for her.

**The Chairman:** It was not a decision I rendered, but it seems to me that we have so much to discuss with these two organizations that we should proceed with that and you can ask her a few questions perhaps.

**Senator Stanbury:** As long as Mrs. Harris will be returning, we had better leave that until another occasion. However, I had found the material that I had received in connection with the organization very interesting. I must say I would like to take the opportunity of congratulating the organizations and those who put it together, the volunteer lady, as you say, and all the other volunteer people, both scientists and non-scientists. If there is one element that is needed in this whole picture, it seems to me it is the element that your organization can provide. I want to be sure that just because we are asking you more questions this afternoon you will not go away discouraged. I would like you to be encouraged.

**Mrs. Harris:** Senator, perhaps if you would give me your questions I might return with some very good answers.

**Senator Stanbury:** If it is going to be two or three months before we see you again, it might be a good idea for us, somehow or other, to review some of the statistics that you are using. I appreciate that statistics are difficult things to be sure about these days. However, the biggest difficulty I had, while there is no disagreement, I believe, between you and the committee as to the objectives which we all seek, was that I found many inconsistencies and doubtful areas in your statistics. It is a little unfortunate that the statistics are being distributed to the public in Canada without having been at least checked against what I believe to be more accurate statistics.

The other point I wish to make and which perhaps is worth while making, even if we will not be discussing the matter in more detail, is that the expenditures of Canada in total health services, not just research but the delivery system also, are something like \$9.6 billion this year and, if not the highest, they are among the highest in the world on a per capita basis. It struck me that while we are talking about how stingy the Canadian government, or the Canadian people through their government, may be with respect to research, we should also recognize that we have the highest expenditure per capita in education in the world. Apparently, we have very close to the highest expenditure in health care in the world per capita, and the question seems to be not so much as to the total expenditure, or stinginess in terms of expenditure, but a question of priorities in terms of distribution of that money. Where should it be spent? Should it be spent in delivery systems or in research systems.

I was going to suggest to you that you thought we were using a horse-drawn Cadillac, or that the research element was really the machinery that made the thing go and that while we are riding in a Cadillac as far as health care is concerned we are having it horse-drawn.

**The Chairman:** In terms of money spent.

**Senator Stanbury:** In terms of money spent on research.

**Mrs. Harris:** I have to answer that from my viewpoint as a housewife. I spend a great deal for a loaf of bread in Canada; I do not necessarily eat the best bread in the world. If you are going to suggest that because Canada



spends such a large amount of money on its entire health care system that, therefore, there is something wrong with the figures I have presented—

**Senator Stanbury:** No, that is not the same basis—

**Mrs. Harris:** I just do not think that you can suggest that by spending a lot of money it is being spent wisely. This is our contention.

**Senator Stanbury:** If I may, Mrs. Harris, my point was not to suggest that we were spending it wisely or unwisely; I was saying that your organization is principally concerned about, as I read your material, the amount of money that is being spent, or not being spent, on medical research in Canada. As I understand it, a great deal of money is being spent in total on health services, and the question seems to be for the Canadian people to decide how much of that is to be devoted to the health delivery system and how much should be preserved for the research element of health care.

**Mrs. Harris:** I would agree with your statement. I do not know that we are even spending enough on our total health care system. I have only heard criticisms of the amount of money that is spent coming from the political world and some members of the press. I have heard very few people who are recipients of the health care system, or very few voters, complaining about the amount of their tax dollars that goes into the health care system, if you want to call it a health care system.

**The Chairman:** Before we conclude on this perhaps we should tell Mrs. Harris that we had a discussion this morning with the Medical Research Council and with the Association of Medical Colleges of Canada. Mrs. Harris, you might wish to look at the proceedings from this morning when you come back. Perhaps you will have another good opening statement at the end of October or the beginning of November.

**Senator Bell:** Before we lose Mrs. Harris for this Afternoon, Mr. Chairman, may I ask her if she would agree with me that since we were spending .7 per cent of the total health and welfare budget on medical research grants until her association came along, and then it was boosted to something a little higher but still under 1 per cent, that the more research that is done the less costly the whole system will be because there will be so many more improvements and there will be no need for the expensive type of health care delivery we have now. Would you agree with that?

**Mrs. Harris:** I would certainly agree that any effort made to improve anything is bound to pay off at the other end.

**Senator Bell:** It is an investment, not an expenditure.

**Mrs. Harris:** It is an investment which we cannot possibly afford to ignore.

**Senator Stanbury:** Dr. Mettrick, perhaps we might begin with the brief of the Biological Council of Canada. I should like to go through the brief. I will start first with the summary, and that may have the effect of shortening some of the questions and answers later on.

It seems to me that your brief exemplifies the whole problem we are having at the present time, particularly in the last sentence of your first paragraph where you say that "Biology is the one science Canada can least afford to neglect." Of course, if we are to listen to the other

representations before us, that should read "Biology is the one science Canada can least afford to neglect, except for all the others."

I wonder if you can expand on that. I appreciate you have given us some of the areas where we need biological research very greatly. But would you expand on your feeling that biology is the one science Canada can least afford to neglect.

**Dr. Mettrick:** There is a misunderstanding based on semantics, I believe. I am using "biology" here in the broader sense. I consider health sciences to be the applied side of biology, exactly as forestry, marine biology, entomology, and so on, are. I admit that some of those are much more important than others, and if one wants to take the major ones, in my opinion if you are subdividing biology you would certainly have the health sciences, agriculture, fisheries, as the major ones and perhaps forestry as another, although forestry again can be a subdivision of agriculture. There are so many interlinkings between them, you see. That interlinking is even brought home by the people who are here before you today.

As I said in the brief I presented, we are all inter-related and what I would like to try to get across is the fact that biology is a closely inter-related science. Advances in one area can very rapidly be applied elsewhere.

To take a good example, Dr. Copp at the University of British Columbia, as you probably know, discovered the new hormone calcitonin early in the 1960s. That discovery and the work which has led now to the production, on a commercial scale, of this hormone, which will be made in Canada, was done using salmon and in close collaboration with Dr. Howe, who was then head of the Department of Zoology at the University of British Columbia. That just illustrates again the close interaction between different areas of biology, which may result in breakthroughs in perhaps the most unexpected areas.

I do not think we can lose sight of this. That is why it should be stressed that it is illogical to single out one sector of biology and spend a large amount of funds in that area trying to solve a particular disease or make a breakthrough in the production of some new crop or something, because the particular piece of knowledge which you may require in order to make that breakthrough may very well come from an entirely different area of biology.

**Senator Stanbury:** That makes it difficult to choose priorities and to set objectives and do all of the things that other people have been telling us we must do.

**Dr. Mettrick:** Yes.

**Senator Stanbury:** In other words, what you are saying is that we need the broad spectrum of research, even if it is not mission-oriented, which is the term frequently used.

**Dr. Mettrick:** We do also accept, of course, that Canada, recognizing that much medical research has to be done in close proximity to universities, hospitals and teaching schools, has contracted out a large percentage of total health science research to the university sector. The amount of in-house federal research in the health sciences is relatively small in comparison to the research done in the university sector. This is not the case in other areas of biology. In agriculture, for example, the major expenditure is through the Canada Agriculture, and Environment Canada again has a very large research and development budget. Even in the National Research Council it is rough-

ly about a 40/60 break between the universities on the one hand and the in-house NRC budgets on the other.

So the health sciences are unique in that aspect. But they do not have a strong federal in-house research program, as do other areas of the biological sciences.

**Senator Stanbury:** That is an important distinction. You have mentioned on several occasions both in your brief and in your initial statement the growth of the in-house, intramural or whatever you want to call it, services in biological research in government agencies, and the distinction seems to be that in the medical field in Canada the whole area of medical research has developed in the universities and university hospitals without the development of national research institutes, whereas in the biological field it has been developing in the universities and then there has been an explosion of need for research and an explosion of knowledge and information and an explosion of problems, which, I suppose, have been loaded onto the government. I wonder whether you might comment on my concept of this? It seems to me that the government people have had the problems come upon them and they have not found the universities adequate to their needs, in the short term at least, and have therefore turned inward and have developed their own intramural capacity to deal with these problems. Is that what seems to have happened?

**Dr. Mettrick:** Well, you are describing what has happened, but, with respect to the reasons for it happening, I would not entirely agree with that. I personally think that the universities were given a proper chance to demonstrate that, together with developing research in government laboratories, there could be what I would term a synergistic association. I think if Canada had to do it all over again we would, for the money invested, have got a better return for it if we had developed research in government laboratories and in the universities in a closer parallel.

One idea, for example, which has not really been tried in Canada, although it has been successfully used in a number of other countries, is that if you identify a particular program—let us take, for example, some area of environmental biology involving a question which needed answering—rather than set up a new section or even build an entirely new laboratory somewhere, on some federal property entirely, as an in-house setup, it would have been better to have considered the possibility of siting some of these centers or institutes in close association with the universities. One good example of this is Agriculture Canada. They have done this. You frequently find that where there is an agriculture faculty, Agriculture Canada has its own laboratory on campus, and there is quite an exchange between them. You can go even further, of course, and have them housed in the same building, especially if it is a small section. The interchange that this will allow, bringing, shall we say, the more applied research being done in the government-sponsored laboratory into contact with the work being done in the university, would permit any advance in the university sector to be transferred immediately and built into the other program. At the moment, of course, there is always this hiatus between publication and knowledge getting around through meetings, and so on.

In this regard I would just make the comment that the BCC, on behalf of the many government biologists which we represent, was very disturbed earlier this year at the reduction in the flexibility of allowing government biologists to attend scientific meetings across the country, and fully participate in this exchange of scientific information

which they can then take straight back and apply in their own work.

**Senator Stanbury:** When did that take place?

**Dr. Mettrick:** This came out at the same time as the freeze—the deep freeze.

**The Chairman:** Do you have any idea of the total federal budget that is devoted to biological research?

**Dr. Mettrick:** I do not have the information in front of me. There is a figure in that table there.

**The Chairman:** Only for extramural funding.

**Dr. Mettrick:** No, there is an intramural figure as well, and the university sector has a percentage of it.

**Senator Stanbury:** There is nothing here for intramural research. It is the natural sciences that are mentioned.

**Dr. Neelin:** There are some figures in this publication, "Tomorrow's Biology." They are not quite up to date, since they are for 1974-75. About \$105 million was allocated for applied bio-science, agriculture, forestry and fisheries, intramurally. Only about \$2.3 million was allocated for medical science, and something in the order of \$50 million-odd extramurally. These figures are taken from a MOSST report on federal and scientific resources, 1973-75.

**Senator Godfrey:** Why are so many of these laboratories located in Ottawa? Do researchers like living in Ottawa, or is it empire building, or is there some advantage in being in Ottawa rather than scattered across the country?

**The Chairman:** Do you mean why are the new government laboratories going in here?

**Senator Godfrey:** Exactly.

**Dr. Mettrick:** They are not all going in here. The two I mentioned in biology are outside. I do not know the answer. I would not like to second guess the ministers involved. There is a saying, you know, "Out of sight, out of mind." I think it would be to Canada's benefit to have them spread around the country. It would strengthen different regions of the country, because it would build up research potential and expertise there. It is not a good thing, really, to have such a strong concentration of scientific activities in one city.

**Senator Hicks:** On the other hand, you cannot deny that where there are concentrations of scientists they contribute to one another, and that you cannot really do first-class work in isolation. That does not mean that you must have only one centre, of course, and it ought to be pointed out that we do have other major centers in Canada, and other conglomerations of research in institutions, and so on, in Montreal, for example, and even in Halifax, which compares very well.

**Senator Godfrey:** Federal research, you mean?

**Senator Hicks:** There are conglomerations, including some federal work. For example, the National Research Council has an Atlantic Research Laboratory on the campus of my university, which works extremely well. It enables the scientists there to have university appointments and have graduate students to assist them in their work. They get the best of both worlds.

**Dr. Mettrick:** That is a good example of this synergistic type of situation that I referred to.



**The Chairman:** If we exclude the Medical Research Council, and the National Research Council grants for biology, it would be interesting to have figures illustrating the relationship between intramural and extramural work in terms of federal funding. I am sure that there is a little extramural funding from agriculture. There is very little from environment.

**Dr. Mettrick:** The figure given in the brief was \$600,000. I believe another half million has since been added to that, but out of a budget of \$90 million, to be spending about one per cent, when agriculture is such a major component of our economy, I think, really, is verging on the criminal. In a recent release from the Science Council on Population and Immigration we have been looking at the potential of Canada to grow in numbers of people, and looking at the food that is going to be available, and agriculture is going to be critical in supplying the food for not only our own people but for export overseas.

**Senator Stanbury:** I would like to follow up just a little more in this area, if I may, because there seems to me to be an important attitude problem, and I am wondering how we can correct it.

You say that it would have been better, as the government found it necessary to pay a greater amount of attention to the biological field, had they done it in conjunction with the universities, by putting their labs on the university grounds or in some such way. It appears, however, that that was not a decision made in government, and that probably the increased expenditures in-house in government to provide this biological research were part of the reason for the pressures to reduce other expenditures on biological research. As evidence of that kind of attitude I would like to repeat something that was said by Mr. Shaw yesterday as President of the Engineering Institute of Canada, when he was talking about the "make or buy" policy. This was in the course of his opening statement. What he said really was that we should find out where our strengths are and that we should build on them, and that where there is an industry or an institution or an element of our society that has built up a strength and can handle something, the government should let them handle it, and where we do not have such strength, the government should do so. The distinction between make and buy is that if the government does it itself, that is the "make" side of the policy. If it should go out to the universities or to industry, that is the "buy" kind of policy. You are putting it out somewhere else.

I just noted some of the things he said that should be made by government. The work should be done by government itself. He says to make research in meteorology, marine geology, wildlife, environmental protection and satellite systems. He goes on and says to buy research in industries which supply or support our great resource industries, and so on. There are some forests not yet considered economic by industry, so make the research that is necessary to develop those forests. To stop the frightening slide in fish population, make. In other words, he is saying that the government should do that themselves. This is an outstanding Canadian and a former Deputy Minister of the Department as perhaps the Deputy Minister of the Environment. It appears from his evidence yesterday that he really did not see, as perhaps the Deputy Minister of the Environment, the possibility of buying from the universities the kind of things that were necessary to deal with such major problems as the Great Lakes, the Mackenzie Valley, Athabasca, Okanagan, James Bay and the Beaufort

Sea. It seems to me the government people, right or wrong, did not see the universities as being capable of supplying the services that they needed at that time, and therefore they went ahead and made them. If that was wrong, is it too late to correct that now? What is your comment on that?

**Dr. Mettrick:** There are some areas where the expenses of carrying out first-class research are so high that you have to have government involvement. Marine services are probably a good example because of the costs of running ocean-going research vessels.

I could ask Dr. Walden, a professor of plant genetics, to answer in relation to agriculture and forestry. He may have some pertinent comments on that.

**Dr. D. B. Walden, Past-President and Professor, Department of Plant Science, University of Western Ontario:** I am quite hesitant to respond. In a sense the examples which you have cited are lacking in specifics. It is hard to talk in such general terms, yet give a specific response. The general point I see in issue about going back to who made the decision about who would do the work is found in an earlier comment you made about attitude. In the last few years we have detected some changes in attitude where there are some haves and have-nots. At the present time in some of the university sector the attitude is emerging that we are now representing the have-nots. They do not have the funds to carry out the research which, if given a chance, they might do equally well, perhaps even better. Certainly, the record of university investigators in plant biology is one of the strong points of Canadian biological science. That is well known throughout the world. I suspect it will continue to be first class if it is fully supported, but it is going to need more of a share than it has at the present time. But if it continues that moneys will be allocated percentage-wise to the other areas of laboratories, we are not going to hold the university in this esteem nor are we going to be able to hold them responsible for problems which accrue 10 years from now in the plant area. I am sure this is true in other areas. We need 10 to 15 years lead time. From identification of the problem, it may be 10 to 15 years before a solution can be found. Take wheat, for example—and this could apply to corn, tobacco and several other major crops—we may be working today on problems that may not surface until 1980 or possibly the 1990s. If we do not give you assistance to manage it in the field now, it cannot possibly be available for the farmer in 10 or 15 years time. This lead time is a very important issue when one is dealing with living systems. It is very difficult to be specific, unless you pose specific problems to me.

**Senator Stanbury:** I felt it was interesting the way the medical research development used the universities, and biological development apparently did not use the universities. It seemed to me there was some judgment somewhere that universities were not adequate for the job of biological research, whereas they were adequate for the job of medical research.

**Dr. Mettrick:** One could draw that conclusion from what has happened. I have not heard anyone argue against the quality of medical research in this country, nor have I heard anyone argue against the quality of biological research in the broad sense. I think it is a case of the university not being given a real chance to participate as fully as they might have in the types of examples you have mentioned.

**The Chairman:** Perhaps an explanation might be that the Department of Agriculture is an older department than is Health and Welfare.

**Dr. Neelin:** Since I represent the society that in fact represents biologists on both sides, the medical and the basic biological side, perhaps I could comment on that.

**Senator Stanbury:** I was just going to suggest that Dr. Neelin might feel free to join in this because so much of the subject matter is the same.

**Dr. Neelin:** In this instance I just wanted to point out that the Medical Research Council was not broken away from the National Research Council until just after the Second World War. My point is that university research potential was built up by the National Research Council during the war, primarily, whereas the Department of Agriculture's Central Experimental Farm dates back to the nineteenth century. I am sure at that time the universities were not capable of supplying the research output that they could in the medical field when the MRC was created.

**Senator Stanbury:** What you are saying now is that we are going to lose the excellence of the universities unless we begin to make much greater use of them.

**Dr. Neelin:** Exactly.

**Senator Stanbury:** One of the objections that you have about the intramural work is that the peer valuation system operates in the extramural work but does not properly operate in the intramural work. Can you elaborate? Is there no check on the work that is done intramurally by scientists in the areas that you are particularly involved in?

**Dr. Mettrick:** Within any laboratory the director has the final say as to whether a particular project goes or not. However, it is not the same today. It is the rigour of scrutiny about the project, designing the experimentation and making sure that the background knowledge is fully understood, and you really have already done considerable preliminary work, shall we say, to ensure maximization of research of monies. Sometimes this is not done so carefully in government laboratories as it is in the case of university research. In the first place, in university research, in order to obtain a grant to carry out the work the applicant proposes to do, he has to prepare a grant submission. This may be a very detailed, complex document, particularly in the Medical Research Council field, but less so in the NRC field. Even there, however, the grants are becoming much more detailed and specific, and now reviewing committees are looking at previous publications of the applicant, judging the value of the work which the applicant has done beforehand, using that, if you like, as an identifier of the research potential of the applicant. This factor is widely used in the university grants program, both by NRC and MRC, in determining whether the applicant is likely to be able to carry out a certain project. However, those in government laboratories, having so many staff, do not have this option.

**Senator Stanbury:** I am under the impression that there are, in relation to some departments in research areas, what I might call civilian advisory groups, people who are in fact peers and who examine what is being done. I wonder whether that pertains in the particular areas doing biological research.

**The Chairman:** There is a definite proposal later in the brief in this connection. I wonder, Senator Stanbury, if we could leave the summary and proceed to the main part of the brief, following our general procedure of going more of less page by page.

**Senator Stanbury:** We can do that. I was hoping to cover the main points by simply taking the questions out of the summary.

**The Chairman:** Apparently we did not have the same approach. I have questions related to the various pages of the brief.

**Senator Hicks:** Before we leave the summary, may I be rash enough to interrupt and underline point 6 in the summary? It really advances many of the questions which we discuss when it comes to trying to evaluate the function of a university in relation to research, because we cannot separate teaching from research if it is to be first class.

**The Chairman:** We will recognize your conflict of interest, senator.

**Senator Hicks:** That does not gainsay the truth of the statement, which was not my statement.

**Senator Lang:** It may not gainsay it, but cloud it.

**Senator Stanbury:** I have covered most of my questions in the first section or two. If you have questions further along, I might supplement those.

**The Chairman:** Are there questions with respect to the introduction?

**Senator Stanbury:** The only point I was going to make, and it is just an elaboration of what we have already discussed, is that most of these special areas in paragraphs (a), (b), (c), (d), (e) and so on, through pages 6 and 7, seem to be areas in which the government has decided to make its own research rather than hire it or buy it.

**The Chairman:** You say on page 6:

Currently, we do not have sufficient data on the fragile eco-systems of the North to be able to provide for the peaceful co-existence of Canada's native people and the proposed technological developments.

How do you account for that? I do not doubt the veracity of the statement, but how do you account for this explanation? Is it because the university researchers were not really interested in this type of research, or that the government did not devote sufficient funds to this?

**Dr. Mettrick:** The inter-university researchers were certainly very interested in this. I have members of my own department who have done a lot of work here and in earlier times. However, the government's own figures are that it now costs in excess of \$100,000 per man-year to put someone in the North to carry out field work. There is no one in universities getting a research grant of sufficient size to enable him to work under such conditions.

**The Chairman:** Who is responsible in the federal government structure for the funding of this?

**Dr. Mettrick:** I am referring to the situation where there is funding by the National Research Council. They just do not give that size of grant.



**The Chairman:** But there are other federal agencies which could support this.

**Dr. Mettrick:** The Department of the Environment is primarily concerned.

**The Chairman:** Or the Department of Indian Affairs and Northern Development.

**Dr. Mettrick:** That is right.

**The Chairman:** Have you made representations to them?

**Dr. Mettrick:** I have not specifically, but I know researchers who were interested in carrying out work in this area who have done so. The problem is really that of combining the university responsibilities with the research function. This extent of travel really cuts it down to something which one could only do on a sabbatical year, or something of that nature.

**The Chairman:** You are really pointing up a very important problem and perhaps it is too late to interfere with all these projects. But has your council made representations to the department to get more research in the universities in this field?

**Dr. Mettrick:** Not specifically, no.

**The Chairman:** So you complain to us, but not to the government.

**Dr. Mettrick:** Well, I am complaining; I am just pointing out to you, sir, a fact.

**The Chairman:** Then, in the following paragraph you say:

By the year 2000, with no new food-producing potential, we shall be a food-importing country...

Are you sure about this?

**Dr. Mettrick:** Well, this was the information that was given at the Rome WHO representatives there. In terms of the potential which we have in new food-producing, recent correspondence in the news media seems to suggest that we probably have a 25 per cent potential to increase current yields, using second-class farming land.

**The Chairman:** When representatives of the Department of Agriculture appeared before us, they were not worried at all by this very serious limitation which you envisage.

**Dr. Mettrick:** Dr. Walden is a specialist, particularly in corn genetics and higher yields and improved crop production, so that question is right in his field.

**The Chairman:** Would you agree with this statement, Dr. Walden?

**Dr. Walden:** The statement in the brief is qualified by the word "potential".

**The Chairman:** Yes, that is the question I ask: Is this true, that by the year 2000 we will not have a new food-producing potential in Canada?

**Dr. Walden:** No, that is not the point, sir. If we cannot develop in the next 25 years these new potentials, we will be in the situation that the brief states. If we continue to carry on the basic research we are doing now, I have considerable faith that we will develop new potentials

which will not bring us to the devastating state in that 25 years in which we would be in the absence of developing this potential. As I said before, the lead time in developing these potentials in food production areas is at least 15 years and sometimes 20 years. The point is that we must be carrying on the research today in order to achieve this by 1990.

**The Chairman:** As we proceed, of course, members of the committee are free to ask questions. I have nothing further to ask with respect to pages 6 and 7. However, I still maintain the Environment Canada and Agriculture Canada—Environment Canada including fisheries and forestry—have quite large budgets in agricultural research. I wonder if this kind of money now is put to the optimum use in relation to the problems you suggest.

**Dr. Walden:** May I respond by referring to table 1, at page 14 in this document, because there you will find the amount of extramural money for 1974. I would agree with you that they are very small sums, and I can assure you that many of my colleagues have in fact applied to Environment Canada and to Agriculture Canada, and they might have been turned down completely or given what I would call token awards. I also agree with you that there is considerable money there which hopefully will be made available to university-based researchers.

**The Chairman:** This has been on the basis of an individual approach to these departments.

**Dr. Walden:** That is correct.

**The Chairman:** What about your national associations. Have they made representations to these departments?

**Dr. Neelin:** In *Tomorrow's Biology*, a copy of which you have just been given, recommendation no. 4 is: "Government departments should provide increased support for extramural biological research which has relevance to their particular missions." Even though, when this document was released in April, we had representatives of the biologically oriented ministries, there was no response to this recommendation. Perhaps, though, in the past we have been remiss by being too passive and waiting for grant programs to be set up to which we could apply, rather than demanding a program be set up. We have waited for the initiative to come from the official side, but I think we have learned our lesson now and we are becoming more active.

**The Chairman:** This magazine has just been issued. Did your association ask for interviews with the director of the Agricultural Research Branch, for instance, in order to discuss the conclusions of this study?

**Dr. Neelin:** Not other than in a group of about this size. Dr. Migicovsky was present, but we have not asked for private interviews with him and not with Environment, as far as I know.

**Senator Stanbury:** What you need is "Canadians for Biological Research."

**The Chairman:** We have some comments waiting for us now.

**Dr. Walden:** I just want to point out that Dr. Migicovsky and others received a draft of *Tomorrow's Biology* six months before it was released, and I, for one, did discuss it with him. So there has been that much additional lead time.

**The Chairman:** What was the response?

**Dr. Walden:** On agriculture? They were pleased that the recent supplementary award of some half a million dollars, which would now be eight months ago, was going to be put into the grants and scholarship area. In fact it has been. The awards from agricultural university-based research went from approximately \$3,500 a year ago to \$5,000 on the average grant now.

**The Chairman:** But when he was before us he told us that if there were more money going to industry or to universities because of budgetary restraints he would have to fire his own researchers and he could not do that. How do you overcome that difficulty?

**Dr. Walden:** I think it is not just agriculture that has this difficulty. For instance, NRC received about \$2.4 million in addition to its normal allocation recently, and it would be my understanding that almost all of that went to cover the increased costs of salaries of government workers. In fact, in terms of research I do not think there was an extra dollar allocated.

**The Chairman:** We have built up gradually. By the so-called "hidden policy" that we describe in our Volume I, we have built up empires and now we cannot destroy them, because of job security.

**Professor K. G. Davey, Chairman, Canadian Committee of University Biology Chairmen, Professor and Chairman of the Department of Biology, York University:** Mr. Chairman, the point I was going to make was that many of the ministries have received not only *Tomorrow's Biology* but copies of its predecessor documents. This is not a recent phenomenon. These recommendations have been put forward for at least three years to my certain knowledge. We may not have dealt directly with the senior officials at the research level, but we certainly pressed our views vociferously with the relevant ministers.

**The Chairman:** I, for instance, have received a considerable number of letters from biologists complaining about the in-house versus the extramural activities. More specifically it has been in relation to NRC. I put the question and some of those letters—there was quite a pile—to Dr. Schneider, President of NRC, when he was before this committee. In answer to all of those interesting letters which I had received from biologists, he quoted to us a Science Council publication in which the Science Council said and I quote: "In the opinion of the Science Council the biological laboratories of NRC can best contribute to the national effort in science and technology by continuing to develop their interests along the lines that now seem to be apparent."

If the advice of the Science Council is being followed by NRC, I doubt that you will succeed in getting much more research funded by NRC in universities. I should like to know to what extent the Science Council publication is supported by your associations.

**Dr. Mettrick:** In general terms, I think that the Science Council document is well supported. Like all documents it has perhaps some specific recommendations we could not agree with.

**The Chairman:** But you say in your brief that if 10 per cent of NRC's intramural activities were to be transferred to universities it would mean an increase of 100 per cent in the support of universities.

**Dr. Mettrick:** I just gave that as an example of the disparity in weighting.

**The Chairman:** It was not an expression of envy?

**Dr. Mettrick:** No. Last year in my own department we had a 10 per cent cut in our budget. We survived. I am not suggesting that the NRC in-house should take a 10 per cent cut and expect to survive, but I was just ready to indicate the relative strengths.

**The Chairman:** I thought that the whole impact or import of your brief was to say that there is too much in-house. When we come to a specific case, however, you say, "Let them go on with in-house activities."

**Dr. Mettrick:** Mr. Chairman, until there is an explicit science policy for Canada—

**The Chairman:** But this is explicit. This is a very specific issue and this is the only way we will make progress. If at some stage you have the courage of your views and you come before us and you say, "Well, there is too much in-house there and we want to have it."

**Dr. Mettrick:** I am talking about the relative weighting. I am not suggesting that you in fact take money from a government laboratory and give it to a university department. What I am saying is that the growth over the last few years has resulted in one far outstripping the other, and whereas in the past, seven or eight years ago, they were in fact on a par, there has been a loss by the universities.

**The Chairman:** When you say that one has outgrown the other there is an implicit judgment there that there was a bad distribution of funds in favour of intramural activities.

**Dr. Mettrick:** No, because a large percentage of that growth has been due to inflation, and the fact that the government intramural laboratories have needed large increases both for salaries and for the sophistication factor of equipment and developments there which have been denied to the university sector. What would have been the logical, successful policy over these years is that both would have grown together so that we would then be in a situation of healthy, viable research in our universities and in government laboratories.

**The Chairman:** So you are not really arguing for the transfer of research activities from government laboratories to universities. You just want to have increased budgets.

**Dr. Mettrick:** Well, what I am saying is that without a specific science policy set by the government I do not think any of us can decide what should be the size of the total science budget of this country. Until we have that figure, we cannot talk about the division of that fund in different sectors contributing to science.

**The Chairman:** But you are quite satisfied about the present distribution.

**Dr. Mettrick:** No.

**The Chairman:** Well, that is what you said.

**Dr. Mettrick:** The ratio of the research support in universities and in the government is not conducive to health research at universities.



**The Chairman:** I am sorry that I do not have the letters I received from some of your members, but they claim that there was too much research being done in NRC as compared with the universities. I put those views to the President of NRC. He came back and quoted the publication of the Science Council, which says the contrary, and now here you are, president of the association, saying that the Science Council is right, and your membership is wrong.

**Dr. Mettrick:** If I were speaking to you, or writing to you, as an individual, I would not argue that the moneys spent in the National Research Council are being misspent at all. That is one area where there is first-class work being done.

**The Chairman:** I am not going to pursue this any further, but it appears we will be able to discard all the letters we have received.

**Senator Lang:** Could work of equal standard be done in the universities?

**Dr. Mettrick:** Yes, in many areas, given the financial support which the NRC has been able to put into certain laboratories.

**Senator Lang:** In other words, it could be done just as well outside NRC as it could inside.

**Dr. Mettrick:** In certain cases, yes. It is a related fact that Canada's only Nobel Prize was won by a scientist working in a laboratory which has been strongly supported and built up by the NRC over a period of many years.

**Senator Bell:** Mr. Chairman, would it perhaps be an indication of where this policy, or lack of it, is taking us if we ask ourselves how we are going to man the laboratories of the National Research Council if we are not able to train new biological scientists to come and fill them? You may remember that Dr. Schneider indicated that he was really rather unsure of where his talent was going to come from.

**Senator Lang:** He had an average age of 40, did he not, in his laboratories?

**Dr. Mettrick:** I think some of the data which Dr. Davey has, on the potential "sink," shall we say, of biologists from Canada is very revealing on that question.

**Dr. Davey:** One of the things I have been doing—not for this particular occasion but for another purpose—has been to survey the departments which adhere to the Canadian Committee of University Biology Chairmen, which embraces just under 100 departments of biology, primarily lying outside medical schools and excluding departments of psychology. I have been asking them to let me have data concerning the numbers, citizenship, salaries, et cetera, of post-doctoral fellows and research associates paid primarily from research grants.

I did this for a particular purpose. You have to understand, first of all, the typical career pattern of a young scientist. After the young scientist obtains his or her PhD, he or she proceeds to undertake a period of almost medieval wandering through various research laboratories as a post-doctoral fellow, broadening his or her research experience, and spending time in full-time research, gradually become more and more independent. I would say, as an employer of biologists, that I would not be prepared to look at anybody with a view to joining my staff at New York University who had less than three years' experience, and many of them have had five. This is not a new phenome-

non. I certainly spent at least five years as a post-doctoral fellow in various laboratories. That is the typical career pattern, and hence measurement of the size of this group gives us some indication of what we have as potential scientists in biology.

Now, the data are not complete. We are still in the process of gathering the data. So far, however, it looks as if, on the basis of the universities that replied—and that is nearly all of them—we have 120 post-doctoral fellows and research associates. Allowing for those few universities which have not replied—and I have telephoned some of them—I do not see how we are going to have beyond 135 at the maximum. We must allow for those individuals in that pool who are not eligible for eventual employment, such as people who are here from other countries, having been attracted by Canada's excellence in a particular area and who have come on temporary visas and must leave the country again at the end of their time in the laboratory. The proportion of people in that category is growing, so the proportion of Canadians and landed immigrants is shrinking.

Allowing for those individuals, I estimate that we have somewhere around 90 potentially employable post-doctoral fellows in the pool. If the mean stay in that pool is only three years, then approximately one-third would be leaving for other employment at any time. That represents, then, somewhere around 30 or 35 people entering permanent employment as research biologists in all categories. Is this too large or too small a number? I do not know, because we do not have data about the demography for example, of departments like agriculture, with very large biological research organizations. If you assume that from entering university to exiting as a fully qualified research person requires a minimum of about 11 years—approximately a decade—then we had better be looking a very long way down the pipe indeed. I would like to see data about what the needs of various government departments are likely to be over the next decade. I am not confident we are producing enough people now, and that we are in a position to provide individuals to fill the vacancies that are likely to occur over the next decade or so.

**Senator Lang:** What is the demand from industry for biologists?

**Dr. Davey:** It is very small for PhD. biologists. There is very little research being carried out by industry.

**Senator Stanbury:** And from the universities?

**The Chairman:** What about MAs?

**Dr. Davey:** We have less data on them. I do not know at the moment.

**Senator Yuzyk:** What percentage leaves the country for the United States, permanently, to take up employment there?

**Dr. Davey:** Again, I do not know. These sorts of data are very hard to get. I suspect the number is small. Many of these people, of course, go to other countries during their period as post-doctoral fellows, and return to Canada later, just as many students come from other countries to Canada and return to their homes.

**Dr. Mettrick:** There is one additional piece of information on that subject. Information from the Canadian Association of Graduate Deans indicated late last year, 1975, that people who graduated with doctorates from division 4,

which has been defined by the association as including the life sciences—agriculture, medicine, biology, and so on—was, I think, 380-odd. This was just about half the number of PhDs graduating from division 3, which includes the physical sciences, such as chemistry, physics, mathematics, and so on, I think that if you reckon on only well under 400 doctorates in all areas of biology—and I am defining biology in the broadest sense here, right across the country—this is a very small continuing turnover.

Specifically, as an example of that, in my own department we were making three appointments this last July 1 to faculty positions. Two or three years ago, whenever we had a vacancy, we were getting anything up to 150 applicants per position. Of those three positions this year, the maximum number of applications we had for one of them was 29. I think that is an indication that in biology the potential “sink” of biologists has pretty well dried up.

**Senator Yuzyk:** We are very much interested in our potential for the future. Does your Council have in its program a project to conduct an inventory of all those involved in biology and related fields? Have you ever undertaken an inventory? If you have not, would this not be a good project in the near future?

**Dr. Mettrick:** To answer your first question, no, we have not. It would have to be something done in a broader mandate, possibly in conjunction with the federation. Together this would, in fact, probably give a broad picture of biologists in both government and outside—in industry. With respect to biologists within the universities, the CCUBC has the best stature on that. They made an inventory two years ago on the number of graduate students, and documented the declining enrolment in division 4 in Canadian universities over this decade so far. The brief refers to the rather extraordinary situation across the country of a 19 per cent increase in enrolment in our graduate schools, but specifically, when you look at division 4, the life sciences, you see a decrease of 8 per cent.

**Senator Lang:** When did this decrease commence?

**Dr. Mettrick:** Since this decade—since 1970 onwards.

**Senator Yuzyk:** In other words, students do not see any future in the field of biology.

**Dr. Mettrick:** They can read the writing on the wall, the same as we can.

**Senator Yuzyk:** Something must be done.

**Dr. Mettrick:** Yes. Against that background you also have the extraordinary growth in the number of undergraduate students taking biology because they are extremely interested and realize the importance of biology in any curriculum.

**Senator Lang:** Where are they going to find their careers?

**Dr. Mettrick:** These are undergraduate students and they are taking some biology courses as a mandatory component of any liberal arts type of background.

**The Chairman:** Perhaps some of them might find that they are better with an MA than with a PhD.

**Dr. Mettrick:** Yes. Most of them are not going on to careers in biology. In the University of Toronto, for example, on the downtown campus in the faculty of arts and

sciences, the enrolment each year of freshmen is just over 3,000. Two thousand of those—that is, two out of every three—take the introductory biology course offered by my department. But the pyramid drops off. They have taken this to get a background of modern biology to increase their understanding of the biological components of today's problems.

**Senator Carter:** As a supplementary, there is not anything wrong with expecting government to have responsibility for the supply of biologists or biochemists. What about industry? Do they feel any responsibility in that respect? How about the forestry industry, for example, or the agricultural industry, even the packing industry?

**Dr. Mettrick:** I do not know. I must admit that the BCC up to now has not been closely associated with things like the forestry industry or the agricultural industry. It is only in the last six months that we have made approaches to them, and are looking forward to a joint meeting this fall to explore our common ground and interest.

**Senator Carter:** Should not the cry of alarm be coming from them, as well as from you?

**Dr. Mettrick:** I do not think they are as aware of these facts as we are. We are right next to them. We are conveying them to you. We have done so both in this document and some of the other earlier ones, particularly the one published 18 months ago by the BCC.

**Senator Carter:** Should your organization not be making them aware of it?

**Dr. Mettrick:** I can document many occasions when we have been to MOSST and explained the situation.

**The Chairman:** Your students cannot be very encouraged to pursue a career at the graduate level when they read this statement from your brief:

—because our understanding of biological problems is not yet sufficient for us to be able to predict, within the very broad area covered by the Life Sciences, where there will be demand for trained manpower in 5, 10 or 20 years time.

So if you do not know what the demand will be because of your lack of knowledge of our own biological problems, how do you expect students to decide to pursue a career in this area?

**Dr. Mettrick:** The NRC has addressed itself to the same problem—or the biological section in it. What the various granting committees have tried to do over the last few years is to maintain across Canada, by means of these research grants, a broad potential for biological research in our universities in as wide a field as possible, so that we can at least keep in Canada a cadre which could be mobilized in certain areas if we wished.

**The Chairman:** To paraphrase Marx, you have your own research reserve army, as opposed to an industrial reserve army. You have your own research army, but you do not know exactly where it will be used.

**Dr. Mettrick:** If you have, for example, five professors in five universities across the country, all in some particular field of biology, and if there came about a national demand for this, bearing in mind the lead time which Dr. Davey and Dr. Walden have been talking about, those five people could in fact build up larger graduate programs in their laboratories and lead the way.



**Senator Yuzyk:** If they do not die in the meantime.

**Dr. Mettrick:** Exactly.

**Dr. Walden:** May I make a comment about undergraduate students? I am very close to them. Interest up to now has proved that today, as compared to five years ago, there are more undergraduates applying to do graduate work than we anticipated. The numbers are higher, and there are two factors which change the profile. Up until two years ago the Canadian graduate schools were open to students from outside Canada. Our immigration policy has now dried that up. So you must take this into consideration.

The second factor is we are now literally rejecting some of our students because we do not have money to support them as teaching or research assistants. In point of fact, the interest is still there. I would submit it is there in greater proportion than at the undergraduate level, and it is the upper graduate level where the crisis has really hit.

**Senator Lang:** I can see the crisis after they have finished their PhD. It seems to me that there must be some way by which these men can be absorbed into the economy.

**Dr. Walden:** I agree, sir. There is probably not an employment crisis in biology at the present time. You heard Dr. Davey mention 135 post-doctoral fellows in sister sciences—chemistry and physics. The number is three to five times that in Canada. That is where the unemployment problem is in terms of the basic sciences. It is not in biology. We do not have at the present time, in my view, enough to fill the demands of this country even in the next five or ten years.

**Senator Lang:** Even with that lack of demand in industry?

**Dr. Walden:** That is right. There never has been a demand.

**Senator Lang:** Do they go to the NRC, or back to teaching?

**Dr. Walden:** You realize a tremendous growth has taken place in universities, and the average age of your professor of biology is increasing every year and we will soon be faced with the question of where those replacements are to come from. I submit that we will be back to an immigration problem as we faced in the early 1960s.

**Senator Lang:** That is an interesting observation. I wish I had some contrary opinions from my university experience.

**Senator Stanbury:** There is one point that I wish to discuss. I appreciate the point you are making at page 9 with respect to the role of universities, professors and so on, and the relationship between universities and scholars, and the fact that professors must also be scholars. I wonder whether, in fact, government agencies really do not involve students in the learning process also. In other words, do they not hire, or borrow, university students and involve them in the projects on which they are working in the Beaufort Sea and all those marvellous and exciting places in Canada?

**Dr. Mettrick:** Yes, they do. Many government scientists are cross-appointed in one form or another to universities and have their own graduate students. I think it is almost

universally accepted by universities that in no way, or at no time, does a student do his entire graduate work outside the university. The reason is that it is only within the university environment that they get the interchange of ideas between students within a department on a wide range of subjects, and also the opportunity of talking to and discussing with staff outside that department and even outside the faculty. When students are training in a government laboratory, or working with a scientist there, the field of inquiry is much more defined, and the training that they receive is not likely to be as broadly beneficial when that student leaves and goes out into the market. Many of us today, in training our graduate students, are accepting the fact that during their career they will not spend the rest of their life working on projects related to that on which they did their PhD. They will have to be more acceptable to the jobs and work they do, and this flexibility is much easier and better built-in in universities than in government laboratories.

**Senator Stanbury:** Is there room for improvement in the cooperation between universities and government agencies who use biologists in research in terms of the handling of students?

**Dr. Mettrick:** In my own department we have many cross-links with the Royal Ontario Museum; some of the faculty are on the staff there. Dr. Neelin, I believe your department represents a particular situation.

**Dr. Neelin:** We are in the fortunate position of being in the capital, where so many laboratories of the federal government are located. We have 10 or 11 adjunct professors who are, in fact, full-time employees of the government laboratories. There is an agreement between our university and each of their respective agencies, which is essentially for some portion of their time, for perhaps 5 per cent of which they are seconded to the university. They never leave their own laboratories, but we send them students and they devote that proportion of their time to guiding the students.

In my opinion, we are unusually privileged. This could be enhanced if the government laboratories in their future expansion, for example, were to enlarge upon the rather limited number of smaller laboratory institutions that they have scattered around the country. NRC has only two. The Department of Agriculture, I believe, has many more, having their research stations. There are three or four Fisheries Research Board laboratories.

However, the relations in general are not intimate. I worked in a Fisheries Research Board laboratory and at the National Research Council before going to Carleton, and the number of individuals holding a cross-appointment is very small. There might be one in the whole building. One of the government employees might have a professorial appointment. There might be one student working in that laboratory, and thus he is very isolated, as Dr. Mettrick describes. In my opinion, if the relationship were much closer, it would be much more fruitful.

**Senator Stanbury:** So you would be happy if we were to recommend that efforts be made to increase that relationship.

**Dr. Neelin:** In my opinion, it would work both ways, helping the professors and students in the universities and it might keep a few more government employees happy and stimulated also.

**Senator Stanbury:** I assume it is those you describe as "fossilized or thwarted would-be researchers", at the foot of page 10? The distinction is drawn between "parctising scholars" and "fossilized or thwarted would-be researchers". I can only assume that those would be the government people.

**Senator Hicks:** I should add, as a footnote, that the proportion of those involved from the government laboratories of various types in the Halifax area is much larger than your reference.

**Dr. Neelin:** But I think that is a good illustration of the way in which the relationship was designed. The NRC Maritime Region laboratory is on the campus of Dalhousie University; the Fisheries Research and Technological Station is two miles down in the harbour, and there are no students there.

**Senator Hicks:** On the other hand, the Bedford Institute of Oceanography is across Halifax harbour and a great number are involved there.

**Dr. Neelin:** It must depend on the director, and so on.

**Senator Hicks:** Sometimes it depends on the individuals.

**Senator Carter:** I have a question with respect to page 10—the passage you quoted, Mr. Chairman:

—our understanding of biological problems is not yet sufficient for us to be able to predict, within the very broad area covered by the Life Sciences, where there will be demand for trained manpower in 5, 10 or 20 years' time.

As you understand it now, what are the main biological problems facing Canada and what is being done to make the people and the government aware of them?

**Dr. Mettrick:** If I had to give a short answer to that, the areas on which I would put the highest priority would be agriculture, forestry and marine sciences.

**Senator Carter:** Those are general areas, but I am thinking of specific problem.

**Dr. Mettrick:** Specific problems in agriculture? I would take the development of strains of wheat which can be grown in a shorter growing season.

**Senator Yuzyk:** That is being pursued pretty well.

**Dr. Mettrick:** That is right; that is the type of work which must be done and has the type of lead time to which Dr. Walden referred.

**Senator Yuzyk:** But where are we completely short, or deficient?

**Dr. Mettrick:** One of the major problems, if we go right back to the beginning, is that we do not even know what the biological fauna and flora of Canada is *in toto*. Until we know this, then in many cases we cannot even start to talk definitively of what has been or will be the effect of this or that particular problem. I can cite a good example of this. As you will recall, the cost of sugar suddenly shot up a few years ago, which caused a number of botanists to re-look at the potential we have in Canada for sugar beet varieties.

**The Chairman:** It also caused the firing of a minister.

**Dr. Mettrick:** And the number of genetic stocks which had been lost was frightening. Think of how many times

that is being carried out for other crops which we now use. There is no facility at which these can be maintained at some very low level so that we would still have the genetic potential.

**Senator Yuzyk:** Is there any program to study the potential we have, and that we have not developed, in order to take advantage of it?

**Dr. Mettrick:** Yes, in two ways; the BCC did in fact two years ago endeavour to negotiate a nationwide biological survey. As part of that, the Entomological Society of Canada was very interested in carrying out a particular survey in that area. The minister was not in the least interested in this type of national survey, and when we were discussing matters together before coming in to this meeting Dr. Walden mentioned that the Entomological Society of Canada has now got a little preliminary funding to start doing this type of survey. There are a few other botanical societies which have started to do national surveys, mainly starting on a regional basis and then putting them together. However, of course, you will realize that it is always the last stage. It is easy enough to do what we have here, here and here, but then to do the last stage, when you put in the intervening uncharted spaces part of it, is the longest stage and the most costly.

**Senator Stanbury:** I really wanted to check the graph, figure 3 on page 14, and the explanations of it which appear on page 15. It seems to me that we have a lot of apples and an awful lot of oranges, and perhaps there are even peaches, pears and everything else in there. It does not look very comparative to me. For one thing, I notice that several of the countries are confederations while others are unitary regimes. I do not know whether there are any provincial expenditures included for Canada, or whether we have the expenditures of industries and societies. The explanation on page 15, so far as I can see, simply admits that they are not the same thing.

**Dr. Mettrick:** Yes, I think that is a fair comment.

**Dr. Neelin:** Not having compiled the graph, nevertheless I will come to its defence. Surely one still has to admit relative changes; that it, with any line, the source of information has remained constant. The same agencies have provided the information, and, let us say, therefore, in West Germany there must have been an increase.

**Senator Hicks:** Furthermore, even if a very large magnitude of error exists, Canada still cannot possibly come out very well in the comparison.

**Senator Stanbury:** I take note of that point.

**Senator Yuzyk:** Have you any statistics available at all for the Soviet Union and China?

**Dr. Mettrick:** The short answer to that is no.

**Senator Stanbury:** And if you do, do you believe them?

**The Chairman:** I am sure Senator Yuzyk would have them, if they are available anywhere.

**Senatoz Yuzyk:** I shall have to do some research.

**Senator Stanbury:** I suspect the Chairman has a question about the bottom of page 15.

**The Chairman:** Yes. I should like to know where in Volume 2 we suggested that Canadian spending for research in universities was excessive?



**Dr. Mettrick:** Specifically, I can recall that in your invitation to us to make this brief you submitted some Xeroxed pages of recommendations from your last report which had particular relevance to biology and science, and my recollection is that the reduction from 25 per cent to 10 per cent—

**The Chairman:** I am not speaking about that. I will come to that later. But the first statement you are making is that we expressed the view in Volume 2 of our 1972 report that Canadian spending for research in universities was excessive to begin with. You say that was the view expressed. You cannot equate research in universities with basic research.

**Dr. Mettrick:** In fact, that would be our assumption, if you are recommending that something be reduced from 25 per cent to 10 per cent. Naturally, the assumption is that 25 per cent is excessive, and that is why you want to reduce it.

**The Chairman:** Let us come to the second point later. The first point is that you say we expressed that view in Volume 2.

**Senator Hicks:** I don't understand, Mr. Chairman.

**The Chairman:** There is a statement here saying that Canadian spending for research in universities was excessive to begin with.

**Senator Hicks:** But surely that is a question. It says, "The second question is whether Canadian spending for research in universities was excessive to begin with."

**Dr. Mettrick:** I am meaning that in the sense that this must have been what you had thought, because you recommended a reduction from 25 per cent to 10 per cent.

**The Chairman:** But I understand that there is a lot of applied research and even development going on in universities.

**Dr. Mettrick:** Right, but we are talking about the basic research as one component.

**The Chairman:** No; you say, "Canadian spending for research." Well, I wish you would substantiate that point. Then, of course, the other point about the 10 per cent is taken completely out of context, because you will remember, I am sure, that we suggested that this 10 per cent be taken in direct relation to the almost doubling up to 2.5 per cent of the GNP, for a total increase in research and development for our national efforts. So the 10 per cent did not at all represent a reduction in expenditures devoted to basic research. As a matter of fact, it represented a substantial increase. So when you take the 10 per cent without relating it to the 2.5 per cent, your statement becomes completely misleading so far as our report is concerned.

**Dr. Mettrick:** Yes, I would have to say in reply to that that there are other people, including the ministry, who have used that particular recommendation to hit us over the head, as an example that they were merely following what you recommended.

**The Chairman:** It shows how dangerous it is, even for scientific people, to take one specific recommendation without relating it to the others.

Of course, if you accept that that is a misleading statement, it then follows that the following pages, at least so far as I am concerned, have no relevance. I am therefore prepared to skip them.

**Dr. Mettrick:** Provided, Mr. Chairman, we are all agreed.

**The Chairman:** Again, you see, on page 18 you say:

Your views and recommendations appear to have significantly influenced thinking, and led to similar reports being generated within Federal government departments.

Well, we are not responsible for the government's misrepresentation of our own report, and I do not see why, if they have misrepresented our recommendations, you should do likewise.

**Dr. Mettrick:** From what you have said, there has been a considerable misunderstanding of the point you have made.

**The Chairman:** And especially we are not responsible for the publication produced by Environment Canada which says that the universities should be reduced to their teaching role only. We never said that.

**Dr. Mettrick:** No. They were just taking it even further and going on from your recommendation. Their assumption was that, if you were reducing basic research in universities anyway, then you should do the whole thing and cut out basic research entirely. That was simply going even further than you had gone.

**The Chairman:** I hope you will reread our recommendations, and also the evidence and paragraphs supporting those specific recommendations, and take them as a whole instead of separately.

**Senator Stanbury:** Mr. Chairman, we have spent a good deal of time on the undergraduate and graduate students in our science programs, and I think we can pass on from there, unless someone else has additional comments.

**The Chairman:** If I may just draw one more conclusion on this other point, when you come to page 27 of the brief, you put a rather different construction on your recommendations; you say:

The conclusion that seems inescapable is that the earlier warnings of the Senate Committee that increases in mission-oriented funding should not be at the expense of the traditional funding based on scientific merit and potential for fundamental discoveries, have been ignored or rejected.

If our recommendations have been ignored or rejected, it means that your earlier interpretation of our 10 per cent was not right. I do not know whether the two parts of your brief were written by the same author, but it seems that the two comments are not consistent, and I prefer the comment on page 27.

**Dr. Mettrick:** I am sorry, Mr. Chairman, that Dr. Harvey could not be with us today. Unfortunately, he has pneumonia. Naturally, I do not wish to disclaim the entire responsibility for this, but—

**The Chairman:** You will agree that the two statements are not entirely consistent.

**Dr. Mettrick:** Yes.

**Senator Stanbury:** I now go back to page 20, and the question of undergraduate and graduate students in the life sciences. I just wanted to ask a short question, perhaps, to get it on the record—because I do not know the answer, and you may not either—but what I would like to know is:

Does the Department of Manpower not take some responsibility for surveys of future needs for professional people in professional occupations? I do not know the answer to that, but it seems to me you might suggest that there be some leadership given by the Department of Manpower, and perhaps facilities made available to help do this kind of survey.

**Dr. Davey:** Anything that could be done to generate statistics, in terms of even a survey of the demography of the scientists within the federal government laboratories, and a statement from the government about their intentions in terms of replacing these scientists when they retire, would be welcome.

**Dr. Neelin:** I might mention, since we seem to be considering the two areas simultaneously, that in biochemistry the situation has been quite different. Some years ago—I would think five years ago—it seemed to be generally anticipated by the schools of biochemistry, and the departments of biochemistry in medical faculties, that the demand was slacking off, and most of these departments consciously began limiting to a rather specific number—in fact, the Canadian Biochemical Society recommended to their membership that they limit the number—of graduate students accepted, not because Canada did not need more biochemists, but because we did not want to produce PhDs who could not be placed. Perhaps Dr. MacLennan could deal with this, because he is in the Department of Biochemistry, and I am not. Has not the number really been pretty well spontaneously—well, perhaps not quite spontaneously, but internally—adjusted to the demands?

**Professor David MacLennan, Banting and Best Department of Medical Research, University of Toronto:** Yes. That is true. It has been cut down to one or two students in our university. The demand for biochemists in university positions is rather small—about six to eight positions per year opening up.

**Senator Stanbury:** Is that based on any long-term survey, or is it just the gut feeling that the professors there have?

**Professor MacLennan:** It is based partly on the reaction of the students, who could see what was coming, and they did make representations to the biochemical societies, who acted on them.

**Dr. Mettrick:** In regard to that, so many universities are funded on this per capita basis—in other words, one which is dependent on the number of undergraduate and graduate students enrolled—and it is the experience in our department that in virtually every case where we have had a student who has been a terminal master—that is, where we have refused to accept him for going on to a doctoral degree—he has been accepted by another university, often within the same province, and has completed his studies there. This method of funding universities, which encourages, shall we say, some of the have-not universities to take any students they can and thus increase their funding in that way, is an unfortunate fact of life.

**Professor MacLennan:** The problem of employing young biochemists does arise. It is noticeable in our department. When we try to attract the first-rate, the very best, young biochemists, we find that many of them are taking graduate studies in the United States or in England or other countries. We try to attract them back to Canada, and we have a very difficult time in the present research environ-

ment that we have in Canada with regard to getting really first-rate people. Of the last three jobs we have offered in our department, we have been turned down by two first-rate young Canadians who really preferred to work in the United States, and on the third try we have been able to appoint a Canadian who had been working in Geneva for three years. The attraction to Canada is really minimal in the present state of research.

I think you noticed this morning that Dr. Brown said that the bio-hazard problem is not very great in Canada, and this affects the problem of employment. The people we were trying to employ were working in the DNA area, and did not see much future in Canada for it, and preferred to work in other countries.

**Senator Lang:** You say our bio-hazards are not very great?

**Professor MacLennan:** I am talking about DNA recombination. This is the area of bio-hazard that Dr. Brown was discussing this morning. This is the forefront of biochemical science right now, and there literally is no one working in this area. We are trying to attract people in Canada to develop this area, but it is very difficult to make appointments. So we really have a problem in attracting them.

**Senator Lang:** Is the United States not trying to legislate against this?

**Professor MacLennan:** I am talking about this as the forefront of knowledge. This is really the forefront of biochemical investigation, and we are not leading in that area.

**Senator Lang:** Perhaps we should not be.

**Professor MacLennan:** Well, that is a question for debate.

**Dr. Neelin:** Maybe we should not do research in nuclear power, either. There are some things you have to do.

**Senator Lang:** I think this is a little more dangerous than nuclear power. But that is a personal opinion.

**Professor MacLennan:** That question is being debated among scientists as well as among lay people, so it is not a matter of agreement.

**Senator Stanbury:** I am concerned about the time, but it seemed to me that there was a fairly important charge at the bottom of page 22, and I think it is important for us to see whether there are any suggestions as to the needs of remedying it in the future. You say:

It must be recorded that, over the period in question, industrialists and scientists, through the NRC, did not successfully re-orientate the major thrust of the NRC Grants-in-Aid programme, either in terms of setting national objectives for science, nor by simply adjusting funding to take into account the changing distribution of Canadian scientists.

I just wondered if you might elaborate on that, and perhaps indicate what we should be doing about it, or if there is something that can be done about it.

**Dr. Mettrick:** This has arisen, really, from the changing demographic pattern of student involvement in universities. Since the late 1960s there has been a tremendous increase in numbers of students interested in biology, and concomitant reductions in other areas. The result has been that universities have continued to make faculty appoint-



ments in biology, while they have either even cut back or suddenly held the line in appointments in other sciences. The point we are making here is that—specifically last year, when the NRC initially had a 17 per cent increase in its budget, which was later cut back to about 15 percent—this was a real opportunity for the Council, without cutting back in any other area of grant support, to redress the current imbalance in funds going into biological sciences and funds going specifically into the physical sciences, and to make greater equity in the average size of the grants to a chemist or a physicist as opposed to a biologist. In fact, that was not done. There was a blanket 15 per cent awarded to all committees virtually across the board, and so that opportunity was lost. Perhaps we are going to wait until the next time there is a major increase, and a significant amount of money, before we can redress the situation.

**Senator Stanbury:** Do you think it is because of inadequate representation by the biological sciences on the committees of the NRC? Or is there some other reason?

**Dr. Mettrick:** It is a question of the NRC itself, as is documented there. You see that over 25 per cent of the NRC granting program is devoted to the biological sciences. We have never had more than two biologists, in the broadest sense, on the Council, and frequently there has only been one. There are 16 members, I think, counting *ex officio* ones.

**Senator Stanbury:** Do you feel that this is an area where there could be some redress?

**Dr. Mettrick:** We have said elsewhere that there probably should be at least four, if not five, biologists who are members of the NRC itself.

**The Chairman:** On page 21 you say that the NRC post-doctoral fellowships have dropped. Do you have the rates showing the ratio of post-graduate scholarships to the number of applicants in the life sciences in recent years? Because if the number of post-graduate students has been declining, it may well be that this ratio has been increasing.

**Dr. Mettrick:** The number of total graduate students in physical and life sciences has been increasing. In fact, it should have been either holding the line, or really an increase in the number of scholarships.

**The Chairman:** You say on the previous page that there has been a decline in graduate students in the life sciences.

**Dr. Mettrick:** That is in division 4. But in division 3 there has not been this decline and that has resulted in this large sink.

**The Chairman:** That would apply to the post-doctoral scholarships?

**Dr. Mettrick:** This is in all fields. These post-doctoral fellowships are in all fields. I might have anticipated that biology might get only one-quarter of them, at the most.

It has been the policy of the NRC—and I have been a member of the animal biology grants committee now for four years, and am currently chairman—in trying to maintain the level of the individual grants in aid, that these sorts of cuts have to be made elsewhere.

**The Chairman:** You would not have any specific figures of the ratio for the life sciences?

**Dr. Mettrick:** No.

**Senator Stanbury:** I am just wondering if you are making a suggestion on page 25. You say there are four points evident from the data presented. The first is that no less than 10 federal agencies are involved in research support in the life sciences. Would you suggest that there should be only one—that somehow they should be worked together?

**Dr. Mettrick:** The point is to indicate there are so many areas in science where biology has a component and an interest.

**Senator Stanbury:** You are not proposing something should be done about that.

**Dr. Mettrick:** No. It does bring home this pervading importance of biologists.

**The Chairman:** On the previous page you claim that biologists supported by MRC received much more in general grants than those supported by NRC, apparently for more or less similar projects. How do you explain that?

**Dr. Neelin:** These figures were taken from another publication. The purpose was really to demonstrate that biological research is, in fact, now cheaper than research in other disciplines; that the Medical Research Council recognized that a broad spectrum of budgets for individual grantees was necessary to do certain kinds of research in physiology, cell biology and genetics. But with the budgets available to them, the NRC biology committees in the same areas were able only to offer, in fact, less than half as much to grantees with similar qualifications. It was really an illustration of the resources available to those committees in the two different councils in proportion to the number of professors who were in fact in these fields; in the two different kinds of faculties. It was not meant to say that MRC, by any means, was getting too much. It was simply primarily to say that NRC was far away from what was required in order to maintain an equal level of research in these disciplines.

**Senator Stanbury:** In your opinion, does that mean that NRC should not be trying to do as much and should be making fewer grants in aid and increasing the amount involved?

**Dr. Neelin:** The rejection rates of the two councils, contrary to popular opinion, are not that different. A new applicant, for example, to NRC has two out of three chances of getting funded. He is not that different from an applicant to MRC. I do not think the standards between the two councils are that different. It is just a matter of what the budgets allow.

**The Chairman:** Yet we are told NRC does not receive enough.

**Senator Hicks:** You cannot overlook the fact that MRC has accustomed itself to dealing with medical doctors. Just as in most universities, the salary levels in the faculty of medicine outstrip those of any other faculty, so the biochemists who belong to medical school probably get paid more than the biochemists who belong to the faculty of science in the university. MRC has been accustomed to dealing in this way.

**Dr. Neelin:** But you understand that these budgets do not go to support the salaries. They go to support the technicians. I think the salaries of technicians in a medical faculty are very close to those of technicians in a science faculty. They are all in the same union.

**Senator Hicks:** That is true. That cuts into the validity of my argument to some extent. Things are usually done more expensively in the medical faculty.

**Dr. Neelin:** They both buy from the same supply house. The cost of the equipment is the same. We are saying that the 1,200 biologists, of whom 200 or 300 are biochemists, because they are in a science faculty and despite whatever qualifications they may have, had better do cheap research.

**The Chairman:** Mrs. Harris will probably have to extend the scope of her campaign.

**Dr. Mettrick:** The implication might be that it is cheaper to give more money to the NRC, and get more research than through the MRC.

**Senator Stanbury:** That is the other side of my question. Should the NRC take on fewer grants and give more, or should the MRC be taking on more grants and giving less? One must be wrong.

**The Chairman:** The ratio of applications to awards apparently is the same.

**Dr. Neelin:** It is difficult to get precise figures from the two councils. But from the best study I have been able to make they are not 100 per cent different, by any means.

**Senator Hicks:** I must admit that is a surprising statement. I was very surprised to read it.

**Senator Stanbury:** One is doing too little, or too much.

**Dr. Mettrick:** If you want to look at it this way, there are approximately an equal number of researchers funded by MRC and NRC. The Medical Research Council is concentrated specifically in the health science area; the NRC is covering every other area of biology. I would suggest that the NRC should not be limited in the breadth which it is now covering in biology. This goes back to the earlier statement made here of maintaining this research potential in a broad spectrum of subjects in biology so that Canada does have this cadre available if and when we need it.

**The Chairman:** This seems to be a very curious division of responsibilities between MRC and NRC. I think your brief touches upon this distribution of responsibilities. How can you explain the rationale between the two?

**Dr. Mettrick:** The medical faculties, on the one hand, are being supported by MRC almost exclusively, and the other faculties have to go to NRC.

**The Chairman:** Even if they work on the same animals, or the same biochemical process?

**Dr. Mettrick:** I think it is a matter of historical relationship. When MRC was created they, I understand, discussed it with the representatives of the medical faculties in Canada. They retained a close relationship with them essentially to guarantee that the research that the federal government wanted done in the medical area was done in the medical faculties. A council was set up to disburse the funds from the federal government to the universities for that purpose. The NRC, going back further, had a rather different mandate, and that was to build up generally the study capabilities of the universities and eventually the research capabilities at the universities in Canada.

There has always been an intimate relationship between MRC and the medical faculties and health science research. I do not represent all of the views of the members

of our societies, but I think it is a regrettable exclusion. Some excellent research of a health nature could be done outside of the medical faculties. I feel this is not being done simply because MRC funding is not available to those individuals, or available only with difficulty.

**Dr. Neelin:** It is too late now, but if one were to put the question to the representatives of the MRC, they would admit that the first to be cut off during the freeze last spring were those outside medical faculties.

**Senator Hicks:** As a matter of fact, it was brought out this morning by the brief of the Medical Research Council that only areas in which there are medical faculties received grants from the MRC during the year 1974-75. The two provinces without medical schools did not receive a grant from MRC.

**The Chairman:** It seems curious that two federal granting agencies divide their responsibilities not in terms of scientific or even social objectives, but according to the division or the structures of universities. It seems to me to be a very unscientific concept.

**Senator Hicks:** It may be but, of course, biology relates to many other areas than medicine, whereas the Medical Research Council is concerned only with those aspects of biology which relate to human health.

**The Chairman:** That goes back to one of our recommendations, which was rejected I believe by your council, in which we suggested that the scope of the Medical Research Council should be extended to become a life sciences granting body.

**Dr. Neelin:** If I could modify that recommendation a little, I think that the Canadian Federation of Biological Societies, at least, would rather see access to their budgets by either faculty; by any university professor who had a project which seemed to fit the mandate of the agency, rather than the faculty he was in. In other words, a medical professor, if he had a project on plants, for instance, extracting something of some significance from a plant, could apply to the National Research Council for support, just as his colleague working on embryos, let us say, in a biological or zoological department could apply.

**Senator Hicks:** But the answer would be that they can apply, and that it is not a matter of rules but of practice.

**Dr. Neelin:** In fact, they send them back pretty prematurely. Very often they do not get past the front desk. There was the ironic situation this year of one of my colleagues in the biology department, a member of the Biohazards Committee of the Medical Research Council looking into the risks of introducing this type of research into Canada, who was denied the right to apply to the MRC for support of his research, even though he was there because he was an expert on that research.

**The Chairman:** When I read the brief, my reaction was that if I were in the position of the biochemists or the other life scientists, and since the MRC grants are more than double those of NRC, I would go to MRC and ask to join.

**Senator Stanbury:** Surely, unless the witnesses see some problem, we should take into account the information they have given us that the grants are so substantially different between the two bodies, and, unless there is some evidence of additional legitimate cost between the two, then there should be an adjustment. It would help Mrs.



Harris' position, perhaps, in the sense that there might be more grants available and more people helped if they were adjusted downward. On the other hand, it may be that the NRC should be adjusted upward. However, lacking some evidence as to why there is this great variance, we should certainly draw it to the attention of the parties involved.

**Dr. Walden:** Mr. Chairman, this point was addressed in recommendation number 4, on page 30 and the analysis and data we have discussed is found on page 34.

**Dr. Neelin:** There is a risk in this recommendation if it is not modified or qualified, in that if we were simply referring to more people dividing up the same budget we would run the risk of reducing even those who are now being funded to even less substantial levels.

**Dr. MacLennan:** I would like to bring out the point that there is a perception of quality that the MRC has taken. That is, that they see an individual or group that can carry research very well and have given them the potential to go to \$30,000, \$40,000, \$50,000 or \$75,000 support. I think it is an extremely wise decision on the part of the MRC to have this particular spectrum of support quality wherever they see it, and to make a recommendation for adjustment would simply throw out this perception.

**Senator Stanbury:** Would it not be wise also for the NRC to have that perception of quality?

**Dr. MacLennan:** I think it would be, but to suggest a compression in the MRC budget would be a disaster.

**Senator Stanbury:** That is not my suggestion. I was saying that, barring some explanation of the difference, we should at least draw it to the attention of those involved.

**Dr. MacLennan:** In my opinion, the main point is that NRC has this very broad spectrum; they have to support a large number of people in several university departments and they have had to distribute their funds much more widely than has the MRC.

**Dr. Mettrick:** If, in fact, the MRC distributed its money more to reflect the number of applications received in the various districts, that would result in a considerable increase in the amount of funding to the biological societies funded by the NRC.

Secondly, there is one quite fundamental difference in the approach of funding by the NRC and the MRC. In very simple terms, the National Research Council tends to fund the research; the program researcher tends to get support for whatever he is suggesting on the basis of, "Here is a man who has demonstrated his competence as a scientist and it is his belief that this is an exciting, interesting area to develop; we will put our money on his people and give him support." The Medical Research Council tends much more to fund the project.

**Senator Hicks:** And have regard to its relevance.

**Dr. Mettrick:** That is right and it then expects that those working in it will be competent, and so on.

**Senator Stanbury:** Mr. Chairman, I have one other, I believe, important area which the witnesses might like to discuss. That is the question of whether MOSST in its present emanation has become increasingly less effective in acting as the essential cohesive force. I am referring to page 31 and following. Perhaps you would like to direct some comments toward that and the proposals which

follow, because this is an area which is of great concern to the committee.

**Dr. Mettrick:** As you are aware, at the moment the minister of MOSST is a part-time minister at best, and, bearing in mind that the budget of that ministry is extremely small and they do not direct any research themselves, I think it would be fair comment to say that the effectiveness of that ministry depends upon the personality and strength of the minister involved. It does not seem to us that the sheer force of moral suasion will be sufficient in defining Canadian policy for science and making sure that it is implemented. I believe that we are saying that while there may be glimmerings of a broader policy, different ministries can and do go in different directions sometimes, and MOSST does not, as presently constituted, have either the moral suasion or the power to, in fact, maintain a broader directive.

**The Chairman:** I cannot understand the wording of your presentation at page 31, where you say:

The most attractive alternative to maintaining the status quo is a re-activation of MOSST's original goals, with the authority from Cabinet to instruct other ministries on appropriate goals and expenditures on research investigations in previously determined areas of importance.

As far as I can interpret the present situation, it is that MOSST started to be a kind of service agency without any real authority whatsoever, a service agency to other departments on the selection of broad goals, programs and all this and that, and recently, without abandoning that mission, they have moved toward a greater authority of review and assessment of budgetary proposals coming from those departments, which will give more authority to MOSST to make its overview and to exercise its original role. So I cannot understand this expression "re-activation of MOSST's original goals."

**Dr. Mettrick:** I am referring here to an address which the Honourable Mr. Gillespie made in his early days as minister, in which he set out the type of direction he was going in. Certainly, the implication from that address was that the goal was to develop a broadly applicable policy of science for Canada, which ultimately would bring the science components of all those other federal ministries which are involved in science into a cohesive program, and which would ensure that there was no overlap between programs, and that they were, in fact, mutually compatible, and that the major thrust of the combined programs would result in the fulfillment of the Cabinet's identified projects.

**The Chairman:** I am sure that when Mr. Gillespie was expounding upon that theme he was expressing a wish, because that did not correspond to the reality at that time. Since then MOSST has evolved in that direction. I can understand why you would like them to go back.

**Dr. Mettrick:** If you want to be specific, we are suggesting that we would go more along with what Mr. Gillespie was, as you put it, hoping would develop.

**The Chairman:** Yes. On page 28 you refer to the peer review system, and you say that you would like to see this peer review system apply not only to extramural research and development activities but also to research and development budgets within government departments. How could it work? You say it would be difficult.

**Dr. Mettrick:** We recognize the difficulties. The article by Dr. Wynne-Edwards and Dr. Neale in a recent volume of *Science Forum* expanded upon the idea in some detail. We felt that it was one which was worth giving some consideration to, as to whether in fact the practical difficulties completely outweighed the usefulness of having this type of review system.

**The Chairman:** We have received, as you remember, a recommendation which goes even further than that, namely that the peer review system should apply, and that their conclusions, recommendations and assessments should be made public, even for intramural activities. Would you go as far as that?

**Dr. Mettrick:** Well, that would be going even further than the present university peer review system. I am not sure that I would advocate that a federal department or division be publicly held up as putting forward bad research projects. The advantage, really, of this peer review system is critical scientific analysis and suggestions for improvement. I think the advantages which would accrue from that type of review is that an outside group, looking at it perhaps from a different point of view, would be able to make some suggestions which the original proponents had not thought of, which could improve the project, the goals and the method of execution to everyone's benefit with the effect of obtaining a higher yield per research dollar.

**Dr. Neelin:** There is, at least, one element to the peer review system which is often overlooked, and that is that it is competitive. Several hundred people are presenting their project proposals in unwitting competition with one another, and, inevitably, there is a selection process which takes place, although not perhaps with fixed project goals defined in advance and a fixed budget. But something like peer review within government services is not novel. I worked for several months in a French government laboratory. A very large group came around once a year and subjected every professional researcher within the institution to a quiz, and then made recommendations based upon what they heard and on the progress that had been made since the preceding year. They shifted resources, or recommended shifting of resources, within the institution to favour those who were productive and showed promise in very much the same way that a grant selection committee does.

**Senator Stanbury:** Did that include people from entirely outside the government?

**Dr. Neelin:** The majority were from outside the government on these commissions. How binding their recommendations were I am not sure, but I know that the scientists lived in terror of their arrival, which is not a bad thing.

**Senator Stanbury:** My understanding is that in some cases we have a scientific advisory committee which does this kind of thing in some areas of our intramural research.

**The Chairman:** Mr. Shaw, the president of the Engineering Institute when he was here yesterday, referred to the broad advisory board, but I do not think they work very properly. They do not have the efficiency of the peer system. They might make very broad comments on the orientation of broad programs, but I do not think they would go into very specific projects and exercise their judgment on those.

**Dr. Neelin:** Another novel aspect of the laboratory in which I worked was that in addition to the projects determined by the goals of the institution, the scientists within the institution were able to apply to other agencies, extragovernmental agencies and even governmental agencies set up for supporting basic research, to take on students and to expand novel areas of research in addition to those determined by their goals.

The university community might rebel or react rather adversely if they heard that they were competing with government scientists, but that is another element of their competition and flexibility. If you do one, maybe you should have to accept the other.

**Dr. Mettrick:** If I might make one suggestion, a possible implementation of this might be that as we have mentioned earlier a very significant fraction, nearly 20 per cent, of total intramural research and development is now, or could be called, basic research. It may be that proposals by government laboratory scientists who want to carry out some investigations in a basic research project area should be by competition within the particular division, and then the people who were unsuccessful in attaining these would be carrying out the other work in the applied and developmental areas which was the mandate of whatever the division was. So there would be really a separation of responsibility.

**Senator Bell:** Mr. Chairman, I have a question which does not arise from either of these briefs. It seems to me that there is a broad area covering biology, medicine, chemistry, and so on which does not drop into any basket. I think the only people who have mentioned it so far are those from the Royal Society. I refer to chemical additives to food. The Cancer Institute is looking at some aspects of this problem, but I don't know what other groups are. What would you do, for instance, if in the packaging of biscuits was an addition of butylated hydroxyanisole, and that this might somehow be drawn into the substances being packaged. Where would you find that out? Where does the training come from?

**The Chairman:** You probably go to either the Department of National Health and Welfare or the Department of Consumer Affairs.

**Senator Bell:** I have tried this, but they do not know. They cannot answer. They say that they have no literature on it. It is very disturbing. It is a broad, broad field.

**Dr. Neelin:** One of the recommendations from biologists, I believe, in the Science Council study, was that there should be an expanded capacity for research in toxicology—that is poisons, and accidental poisons; those that may come from our environment or such things as you mentioned.

**Senator Bell:** What is the point of saying it is safe if you have not dropped dead? This seems to be some of the philosophy in the study. We are not undertaking it in a broad, forward-looking way, to see what the cumulative effect is. How can you tell?

**Dr. Neelin:** I think probably one thing that has developed in this area is the enormous scope of the problem. In a sense, we could be studying the long-term effects of everything to which we are exposed, and that is probably not a bad thing, but it would require enormous investment that not even the federal service could cope with. The Nutrition



Society of Canada is one of our sister societies in the Canadian Federation of Biological Societies, but it is very small, with perhaps 200 members at most. Presumably, most of their research would be in areas like this, but it would be simply a drop in the bucket.

**Senator Bell:** There is a tin, for example, in which a company is putting out fancy coffees, with reproductions of Renoirs on it. If you look at the label you find there is nothing that layman would recognize. There is no coffee, to begin with. Everything is artificial. It is quite frightening.

**The Chairman:** I have just one last point to raise with respect to page 33. You say there that the individual granting councils should have a direct voice at the Cabinet level. As a matter of fact, they have already a voice in Cabinet, so far as I know. The National Research Council has Mr. Drury as its minister, the Medical Research Council has the Minister of National Health and Welfare, and the Canada Council has the Secretary of State. Perhaps they are not speaking enough, or loudly enough, but their responsibility is to be the voice of these councils around the Cabinet table.

**Dr. Mettrick:** Well, as I said, the present minister is only a part-time minister, and the difference is considerable between him and such ministers as those of the Departments of National Health and Welfare, the Department of the Environment, and the Department of Agriculture. Those ministers are each responsible for only one major ministry with a very large budget, and they are able, within their budgets, to set priorities, to a large extent. It seems to us that the voice which is speaking for basic science, which would cover the NRC as well, does not have the same effective strength and power. It may be regrettable but, in our experience, power tends to follow the size of the budget.

**Senator Hicks:** But you are really just criticizing a particular minister or a series of particular ministers. You would not suggest, would you, that some one—say the president of the NRC, or his opposite numbers in the other councils—should go to Cabinet meetings and speak there, thus getting around the responsible minister?

**Dr. Mettrick:** Oh, no.

**Senator Hicks:** What does your suggestion mean, then?

**The Chairman:** We suggested in Volume 2 or Volume 3—certainly in one of the volumes—that the three councils should report to a single minister. Is this what you had in mind?

**Dr. Mettrick:** That would solve the problem, yes, in one way.

**The Chairman:** But that recommendation met with very strong opposition.

**Dr. Mettrick:** Well, yes. It is one of the ironies of Canadian science policy, of course, that we do not all speak with the same voice on our side, and neither does government.

**Senator Stanbury:** I think it is worth commenting that one of the problems we have seen all the way through the hearings is that while everyone really does not want government to interfere, they want government to set objectives; and while they do not want government to increase government expenditures, they want expenditures increased in their areas.

A good example of what I am trying to say occurred yesterday, when there was a strong plea for some one to set priorities and objectives, and so on, and when we asked who should do it, the reply was, "The government, or MOSST should do it." But it was obvious that the various elements of the scientific community and the scientific societies were not able to come to any agreement among themselves as to what those objectives or priorities should be.

As I said yesterday, government has lots of experience in setting objectives with which everybody feels free to disagree immediately, and I am really concerned about this dichotomy. I am afraid our scientific community has not reached a degree of maturity at which they are able to work together and come to a community of purpose, and therefore they want the government to create that community and settle their differences for them, and also provide the money to facilitate the continuation of their separate ways.

**Dr. Mettrick:** If I could answer that one, our problem is that we do not see a rational goal for science in Canada. We do not understand what goal Canada is trying to reach. Where are we trying to get to?

**Senator Stanbury:** But Canada is not MOSST. Canada is Dr. Mettrick and Dr. Neelin and all the societies.

**Dr. Mettrick:** Let me put it this way: the biological community—and I am not speaking for any other—has already, in the Larkin Report, which was a Science Council background study, provided a document that probably gave you the best summation of the opinion of biologists that you can get. It is certainly the most detailed one on record. Now, I would suggest that if we had started with that document, there then should have been a response from government, from the Minister of State for Science and Technology—but which did not, of course, exist then, to the recommendations and proposals that we made. Then the biological community in Canada could have come back again, and we could have developed this dialogue. What we are saying is that we did the background study, we all contributed to the presentation of this document, and it has been ignored. We, individually, have just recently received letters from the ministry talking about manpower requirements and setting priorities in science. Well, this seems to us, again, to be putting the cart before the horse. We have got to go back, as I have suggested, and start with something like the Larkin Report, which is a compendium of biological opinion, get a response from government, reply again from the biological community, and in that way, together, we could work this thing out. But to ignore all of the work that has been done in the past, and which took years to amass, is just a waste of our time and a waste of everybody's time.

**The Chairman:** But I think you have exactly the same complaint in your brief. You say that you unfortunately have not been able to establish formal, effective interaction with government agencies with a view to developing science policy in Canada.

If your individual associations have not been able to establish a working rapport with the government agencies, how do you think this will develop? Because we understand that the support which is behind SCITEC, which is a kind of umbrella organization, from the scientific community, is not very strong. Unless there is a strong voice, and if your individual associations cannot do it by themselves—and I suppose you have tried and have not suc-

ceeded—and if you do not support SCITEC, which would be much stronger if it had the firm support of the scientific community behind it, then there is no way of doing this.

**Dr. Mettrick:** Well, I would say that from the biological point of view, and the three organizations represented here today, we could legitimately claim that as a group we certainly have a cohesiveness, an interaction, and common roles and objectives, and again, as a collective group we would welcome the opportunity of continuing a meaningful dialogue with the minister.

**The Chairman:** And you have tried, and you have not succeeded.

**Dr. Mettrick:** That would be a fair comment, yes.

**Senator Hicks:** But you have not established the same kind of understanding or rapport with physical scientists. Perhaps it is expecting too much for you to think that the minister should bend his ear primarily in your direction. This is why we were concerned, yesterday, at the evidence of the lack of support of SCITEC and what it was trying to do.

In the beginning of your report you use that statement which Senator Stanbury pointed out:

Biology is the one science that Canada can least afford to neglect.

I find it difficult to assign these priorities. I commented with great satisfaction this morning on the fact that our medical people had leaned over backwards not to take that position. Indeed in Dr. Fraser Mustard's covering letter on behalf of the Association of Canadian Medical Colleges, he said:

I wish to emphasize that our Association is just as concerned with the support of research in non-medical as in medical fields, since it is the totality of scholarly activity in the universities that creates the most favourable milieu for medical research.

You prefer support for biology to support for physics, chemistry, or anything else. I wish you had left out the sentence that gave Senator Stanbury the opportunity of starting off by putting a barb into you.

**Dr. Mettrick:** What are we to do as biologists? We are in the position at the moment where we have not got the financial resources from granting agencies to enable us to apply the advances that have been made in the physical sciences to biological models to help us understand life processes. We are tied into historic accidents, funding mechanisms and differences between different types of science. Over recent years we have tried in the NRC to evolve differential shifts of emphasis without success. In the physical sciences you have people that are working at the forefront of knowledge at the level of atomic structure and even further. When you move to the life sciences, a lot of the work there is still at the macromolecular stage. We have not begun to get down to understanding the structure and function of biological membranes at the atomic level. Yet it is only when we get there that we really begin to get a more detailed understanding of life sciences. I feel very strongly that so many of the problems which are going to have to be solved in Canada over the rest of this century have got a very strong biological component. We have already seen so many ministries involved in biological research. We are asking for the opportunity of being able to catch up with other sciences. We do not want to get ahead of them; we want to catch up with them. If we

continually go into this "Catch 22" situation, always being the underdog and the one behind, and if there is some major breakthrough in the physical sciences, it does not help us very much if a crop production falls.

**The Chairman:** You have said exactly what we are saying in volume 2. Biology is the great science of the future, especially molecular biology. We believe this, even if we are non-scientists. We have not succeeded in convincing the physicists or the chemists of this.

**Dr. Mettrick:** I am afraid we have not either.

**The Chairman:** If you cannot convince them of that, the only alternative is to go to the public and try to convince them of that priority. Otherwise the government and parliamentarians will always be in great difficulty, precisely because they are not scientists. We have been told by so many people that we did not know anything about science. We did not know how science worked. As a result of our first report we are becoming more and more timid now in selecting priorities. If you cannot convince your colleagues in the scientific community that you should have priority, then it will be a very difficult problem to solve.

**Dr. Harris:** May I ask a question?

**The Chairman:** Certainly.

**Dr. Harris:** There are several things that have built up towards this question. One was that when I first spoke, Senator Stanbury suggested the word "lobby". It came out that maybe that is what I was, a lobbyist. In all of the discussions with the various associations which have made proposals to this body, you come back to two things: Can you not get together? Can you not convince the public? I do not presume to be the public, but I do not think the public are the ones complaining about the research dollar in any field. I have never seen anything in the press about the general public being in the least bit dismayed about the amount of money being spent. I am wondering if we are getting into a position in Canada where we are going to have to establish permanent lobbies to make ourselves heard. This seems to be a tremendous expense.

Quite recently I was asked to provide figures about a particular disease in Canada. We had figures that have been gleaned globally of the instances of a particular disease in every country. We have no reason to believe that Canada was any different. Yet they want us to do a specific survey. That survey is going to cost us \$180,000. It is not, in terms of numbers, a major thing. Then to come to government and let government know what we want, what we need, what we expect even from the science community, must we then set up a lobby, as is done in other countries, where you spend thousands and thousands of dollars a year just go yet yourself heard?

I do not think the structure of many associations in Canada has developed in that line. Does anybody understand what I am saying here? I felt sorry for the gentleman who said, "Well, you know, if you cannot get your association together..." "They usually get together as a peer group to discuss their scientific interests. To get an association together to only discuss specific points would seem to be something that they could not afford, unless somebody, somewhere, was going to provide them with additional funding to do so.

**The Chairman:** At the moment they have all kinds of opportunities to discuss these issues. The main problem is they cannot agree. It is all right for the scientific commu-



nity to say, "Parliamentarians do not know anything about our work." If they do not agree, and if the public does not make its priorities known, then parliamentarians will have to decide. We may reach the wrong conclusion in a very honest and sincere way.

**Senator Stanbury:** Almost certainly.

**The Chairman:** We are told by the physicists and chemists that if the government does not increase their funding our economy will suffer. We are told that there will be greater unemployment; our standard of living will go down; and they will have less money to give for research in the health field, and in the broader social fields. We are on a merry-go-round, but it is not merry. But at some stage we have to try to break that kind of circle. It seems to me that it would be only normal, as far as we are concerned as parliamentarians, to expect the scientific community to arrive at a certain consensus because they know what should be the priorities as to the different disciplines; what are those that are more advanced than others; what are those which will be more relevant to the country; and all that. If there is no consensus coming from there, I do not know from where it will come.

**Mrs. Harris:** Is the consensus not that they are all underfunded, basically?

**The Chairman:** It is easy to reach that agreement.

**Mrs. Harris:** But to ask for agreement from such diverse scientific communities would, in my opinion, be almost like asking someone living in Eastern Canada, "Which is more important in the month of January—food or heat?" I do not think I am being facetious in making that statement. I do not think we can reach the type of agreement which you ask from the public or the scientific communities.

**Senator Hicks:** I think Mrs. Harris might be right, and since I started this discussion I should say that I am not in any way criticizing the biologists or the importance of biology. I hope you can do it, however, without getting yourselves into the situation in which you would have to say you are more important than physicists or chemists, which would be a pointless argument. I do not think a sophisticated scientific community could exist without biologists, nor do I think it could exist without physicists, chemists or persons in any of the disciplines you might mention. Mine was merely a caveat to try to support your own discipline but not, in doing so, to pull down the importance of others.

**The Chairman:** I do not believe that they were trying to pull down the others; they want more money.

**Senator Hicks:** No, except that it is quite clear in your brief—and I am impressed by this, also—that you have pointed out that the important support from the National Research Council on the basis of your submission seems to discriminate against the importance of your discipline, and I cannot forget the efforts you have made to put forward that point.

**Dr. Neelin:** I do not think the weaknesses of SCITEC were merely because it represented so many disciplines. It also had a very complex structure of representation. It was really too big, and the scientists in it, I do not think, could

get through to it. However, already informal discussions are under way between the two biological societies represented here, the Canadian Association of Physicists, the Chemical Institute of Canada and possibly others, to see in what ways they can cooperate in lobbying.

**The Chairman:** Would it be possible to have a broader association for the physical sciences, the life sciences, the social and human sciences, and the engineers, in four major groupings?

**Dr. Neelin:** You would still leave the biochemists split between the two of them.

**Senator Hicks:** You would be a good example, because you cannot exist without the discipline of chemistry nor without the discipline of biology.

**Dr. Neelin:** Nor even physicists.

**Senator Hicks:** Nor even physicists? Well, certainly if you are going to carry biology beyond the molecular level, you will have to have more to do with the physicists.

**Senator Stanbury:** You will have to go to both, and agree in both places.

**Mr. Chairman,** I am sure you will express our apologies to Dr. Neelin for not really getting down to dealing with his brief.

**Dr. Neelin:** I believe much of it is duplication, really.

**Senator Stanbury:** I was going to say that we appreciate the work that you have done to put some estimate on the remedial budget aspect of the situation.

The other point I thought I might ask you to elaborate your thinking on is in the paragraph at the bottom of page 1 where you say one would hope that the Institute for Research on Public Policy and the Canadian Research Board would have scientists on its board and the various scientific bodies which will be invited to participate actively in the formulation of science policy. Did you have something specific in mind there of some initiative that has been begun?

**Dr. Neelin:** I would ask that Dr. MacLennan, who was in Toronto with Dr. Sheinin when this was prepared, if he could elaborate.

**Dr. MacLennan:** No, I cannot.

**Senator Stanbury:** That is an intriguing area, perhaps.

**The Chairman:** The Institute of Research for Public Policy will appear later this fall, so we will bring that point to their attention, at least.

I wish to thank you all very much. While Senator Stanbury has extended our apology to you, Dr. Neelin, I certainly wish to renew my and his apology to Mrs. Harris. However, as far as she is concerned, it is only an *au revoir*, as she will be back with us in November and perhaps with a better background of our interest in this committee. So we will all be waiting for you when you return this fall, Mrs. Harris.

The committee adjourned.

Appendix "46"

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# BIOLOGY IN CANADA: RETROSPECT and PROSPECT

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A BRIEF BY THE

BIOLOGICAL COUNCIL OF CANADA  
CONSEIL CANADIEN DE BIOLOGIE

SUBMITTED TO THE

SENATE SPECIAL COMMITTEE ON SCIENCE POLICY

FEBRUARY 1976

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Brief prepared on behalf of  
The Biological Council of Canada  
by

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## SUMMARY

1. The way of life of Canada's native peoples is based almost entirely on living resources. Agriculture, forestry, fisheries, wildlife and recreation are important components in the Canadian economy and all are based, in part or in total, on our biological resources. Biology is the one science Canada can least afford to neglect.
2. The large growth of government intramural science research activities has not been matched by corresponding growth in either the industrial or the university sectors. Increased expenditures per se are not evidence of the health and well-being of Canadian Science. A modified peer-evaluation system for the allocation of the R & D budget within government should be given careful consideration.
3. On examination, we believe that the rationale for a reduction in the percentage of basic research, in terms of total R & D carried out in Canada, to be incorrect.
4. As the rationale for freezing NRC grants-in-aid over the period 1969-75 has never been made explicit it cannot be scrutinized. The effect of the 6 year "freeze" is that inflation has eroded away nearly 50% of the funds for university research. Concurrently, there was a substantial increase in funds available for the payment of science activities abroad which now total \$42 million (1975-76).



5. There is a serious inequity in the size of grants awarded to biologists through the NRC and the MRC. Both agencies support an equal number of grantees, but the budget of the MRC is four times greater than that for NRC biologists. In non-clinical biology, MRC grants are, on average, double the amount awarded through the NRC even when the research itself is in comparable fields. Similarly, amongst NRC grants-in-aid, those in the physical sciences are, on average, significantly higher than those in the biological sciences.
6. There is no substitute for universities in the role they fill in education. It is essential that university programmes of instruction and graduate training be offered by professors who are themselves competent scholars. This requires that these professors be active researchers, and that their research has financial support.
7. In the seventies student interest in biology grew rapidly, resulting in undergraduate enrolments more than doubling. Direct financial support for graduate students through scholarships and fellowships is small and the number awarded has declined seriously, resulting in reduced graduate enrolment. The myth of a surplus of doctoral graduates in biology is without basis.
8. The interface between university and government in the biological sciences is very weak. We would prefer a return to the original concept of MOSST, that is, a ministry instructing other government agencies as to appropriate goals and expenditures for scientific

research, while at the same time ensuring that university research remained healthy and was able to contribute fully to a national science policy.

## 1. INTRODUCTION

Since the publication of the Reports of the Senate Special Committee on Science Policy, the problems and positions of university-based scientists in general, and biologists in particular, have changed dramatically. Your recommendations of six years ago must be viewed in terms of their relevancy today, which, in turn, requires an appreciation of what has happened to Canadian science since the "Sixties".

We have attempted to document these developments as they have applied to Biology. Section 2 of this Brief outlines the role of Biology in Canadian science, a re-affirmation of the inter-relationship between basic and applied research, and the question of university education and graduate (manpower) training. Section 3 documents the changes in government policy that, in essence, resulted in the present separation between intra and extra-mural programmes in biology; the unprecedented growth in university enrolment in biology, and the current roles of the NRC and MRC in supporting bio-medical research. The final section looks to the future; the requirements to maintain viable bio-medical Canadian research programmes and the desirable role of the Ministry of State for Science and Technology including its relationship with the granting councils, and individual biologists.

## 2. ROLE OF BIOLOGY IN CANADA

### A) Basic and Applied Research

*"However, not even a small nation can exist simply as a parasite of the international scientific and technological community. It has a moral obligation to contribute to the international pool of knowledge if it wishes to go on fishing".*

*"Because basic science improves the quality of life each nation must make its contribution not only to its own interest and for its own prestige, but for the improvement of humanity as a whole".<sup>1</sup>*

We endorse your words confirming your acceptance of the responsibility that Canada has to contribute its fair share to the furtherment of basic knowledge. Professor R.H.Haynes<sup>2</sup> has recently summarized the cultural impact:

*"More important, the biological revolution has been realized in the development of an elaborate technology that increasingly enables us to implement the consequences of our being a product and a part of natural processes which can be observed, analyzed and modified in hitherto undreamed of ways. The interdependent growth of this revolutionary Weltanschauung and modern biomedical and ecological technique increasingly confronts us with ethical dilemmas and challenges to our values the like of which we have never met before".*

As far as practical significance is concerned, again you have yourselves stated: *"basic science that justifies financial support is not as pure as it is often alleged to be".<sup>1</sup>*

J.D.Babbitt<sup>4</sup> recently made the point:

*"the relation between basic and applied research is fundamental --- to the progress of science itself. Basic and applied research are but two sides of the same coin ---".*

Similarly, D.A.Chant<sup>4</sup> has stated:

*"There is a continuum from basic to applied biology that constitutes the entity we know as Canadian Biology --- To advocate a national programme in Biology, and its support, without the essential ingredient of basic research is like striving to culture a tree without roots"*

A look through the Annual Reports of the National Research Council of Canada, detailing grants-in-aid to university biologists, confirms that indeed much of the work supported through such grants should be classified as "applied" and "developmental" research, as defined in the Frascati Manual<sup>5</sup>, and should not be treated as basic science at all. Historically, research in basic biology has paid its way handsomely via applied applications.<sup>6</sup>

There are also particular concerns for Canadians, because although Canada numbers itself among the countries claiming highly developed technology and industry, it is, nonetheless, a country with major biological concerns. The following illustrate something of the extent of our applied biological problems.

- a) At present, the entire resource base of the Canadian Arctic native people is a biological one. If that is destroyed, the life of these people, as known today, is also effectively destroyed. Currently, we do not have sufficient data on the fragile eco-systems of the North to be able to provide for the peaceful co-existence of Canada's native people and the proposed technological developments.
- b) Canada is a major world food producer, a member of the small group of food exporting countries, and currently produces 20-25% of the world's exportable food surplus.<sup>7</sup> By the year 2000, with no new food producing potential, we shall be a food-importing country, that is if there is anywhere from which we can import food at the turn of the century!
- c) One of Canada's largest renewable economic resources is the Forest Industry. Development and exploitation that does not irrevocably damage this resource, must be based on biological principles.



- d) Canada, having the longest shoreline of any country of the world, stretching over three oceans, has a key central role to play in the management, production, use and protection of the marine resources on our continental shelf; many of these resources are biological resources.
- e) Canada is one of the largest countries in the world in terms of land mass. Our size and geographical location present a range of variation in ecosystems that is still far from complete documentation, let alone understanding. In spite of this ignorance, we have built, and are building or have in preparation the construction of dams and reservoirs that will affect the flow of half the fresh water that flows into the Arctic ocean from Canadian territories. Similarly, two great pipelines are planned, one along the Mackenzie Valley and another from the Arctic Islands.
- f) The problem of biological contaminants in the environment is becoming increasingly important. Biological studies on the impact of industrial wastes on the environment, the routes by which metallic mercury or lead become organic mercury or lead, and how they then move up the organisms of the food chain, are current unanswered questions requiring investigation. The point which cannot be emphasized enough is that the complexity and diversity of Canadian eco-systems means that the mechanisms by which a biological contaminant accumulates in one environment may not be the same as in any other environment. Each requires study and understanding to determine appropriate remedial action.

The Science Council of Canada<sup>6</sup> pointed out that many of the applied biological problems facing Canada are uniquely Canadian. As they put it: *"Nobody else will do it for us!"*. To support this work, our basic biology research programme must integrate and draw on the world pool of scientific knowledge to provide the new facts and concepts directly relevant to the Canadian situation.

In summary, there are major, uniquely Canadian problems in applied Biology which must be resolved and whose resolution will depend on a strong base of Canadian fundamental research in Biology. The first objective of any Canadian Science policy should be to develop these two areas in harmony with one another so that the synergistic relationships between them are maximized.

B) Scientific Manpower and University Education

The second, and related objective of any policy for Canadian Science, is to ensure that there is an appropriate production of Canadian-trained, qualified scientific manpower.

It is a corollary to the accepted premise that Canada has a responsibility to contribute its fair share to the furtherment of basic knowledge, that part of the responsibility is for Canada to produce its own trained scientific manpower. This does not necessarily mean that Canada should be responsible for training all her required manpower, but that, on balance, exporting some research potential and importing other expertise, there should be a very significant component of nationally trained investigators. Traditionally, postgraduate education and training has been largely carried out in universities, leading to graduate certification at the bachelor, master or doctorate level. We have not been persuaded by arguments that the central role of our universities in postgraduate education should be replaced by 'on-job' training. The terms 'education' and 'training' are not synonymous and indeed denote the essential difference between

university-based education, which of course includes a substantial training component, and the strict mission-orientated training programmes operated within other federal and provincial departments and institutions.

Universities are the only institutions in our society which combine education and research at the highest intellectual levels. That is their function - a critical analysis of what has been discovered in the past, the addition of new knowledge to increase our understanding, and the transmittal of the combined information. In the Canadian context other, principally governmental agencies, analyze and add to our knowledge by research which is conducted at the highest levels, but the universities are the only ones that consistently combine the pursuit of "understanding" with the education of graduate and undergraduate students.

In any institution which is a university in both name and fact, the only difference between a student and a professor is that the latter teaches while both learn. Professors are scholars because they continue to learn -- a process usually camouflaged by calling it "research". Research and scholarship are synonymous for learning, although everything that is learnt is not published as visible "research". A scholar's insight and experience is increased continually as he learns, and in the process he develops a clearer understanding of what is known, qualifies judgements and rectifies errors, poses questions that open new insights, stimulates invention and produces new information, all of which add to the sum of what is known. In universities the imparting of information

by a scholar to a student cannot be separated from the scholar's own learning process, or, as commonly called, his research.

In setting objectives or priorities for biological research, it is important to distinguish mission-oriented research programmes from non-mission oriented research. If this is not done, priorities in research become priorities for higher learning. When setting priorities, by definition other areas will be lacking in support, leading to decline of research and understanding in those areas. A substantial non-mission oriented research programme is therefore essential for the continued health of the discipline.

This distinction is important in Biology, because our understanding of biological problems is not yet sufficient for us to be able to predict, within the very broad area covered by the Life Sciences, where there will be demand for trained manpower in 5, 10 or 20 years' time. This is especially true because all levels of government use employment as a tool in fiscal policy -- periodic orgies of hiring are followed by freezes and retrenchment. Therefore, an essential objective for biological research is to keep a very broad spectrum of research activity alive within Canadian universities. The current Grants-in-Aid programme of the National Research Council of Canada already does that to a significant degree. The support, in many cases, is small, but sufficient to keep the research programme viable, and therefore the potential for training further manpower in that area if necessary. More importantly, this broadly based low level of research support does at least ensure that Canada's undergraduate students, who are tomorrow's researchers, planners and policy makers are being guided by practising scholars and not by fossilised or thwarted would-be researchers.



In conclusion, the universities represent a tremendous potential for biological enquiry in both basic and applied research, and for manpower education and training. They are a resource to be managed as carefully as any biological system. At present this resource is grossly under-utilized and under-appreciated, as shown in the next section.

## 3. BIOLOGY IN CANADA TODAY

A. Current Attitudes and Policies, or "How we got here from there".

The question must be asked how the Life Sciences in Canada came to be in their present financial position? What were the Federal perceptions of science during the past decade? How valid was the basis of these perceptions?

In the latter half of the 1960's, the Federal government became concerned with the growth of research being done within the university sector (Fig. 1).

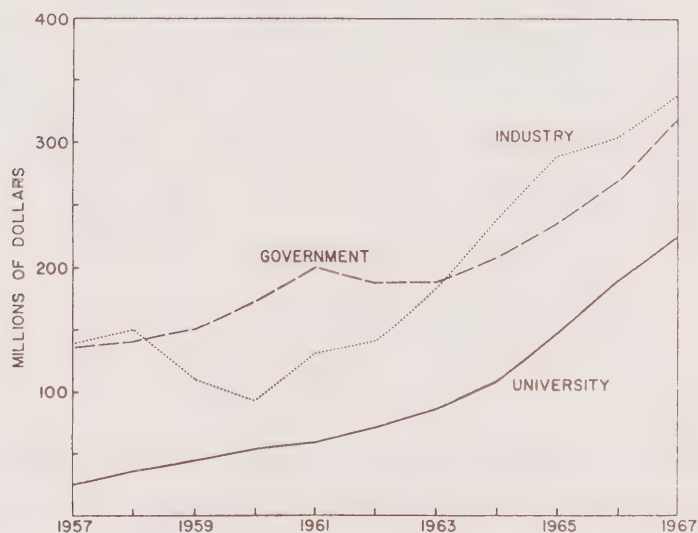


Figure 1. R & D expenditures by three performance sectors in Canada

Source: A Science Policy for Canada. Vol. 1. p. 127.

The decision was made to reduce funding to the universities by "freezing" both National Research Council Grant-in-Aid of Research and in-house research in the NRC laboratories, and secondly by allowing inflation to take its toll. This decision could be made operational rather easily, in that the same minister was both responsible for the NRC and was President of Treasury Board.

The effect of this policy is clear (Fig. 2).

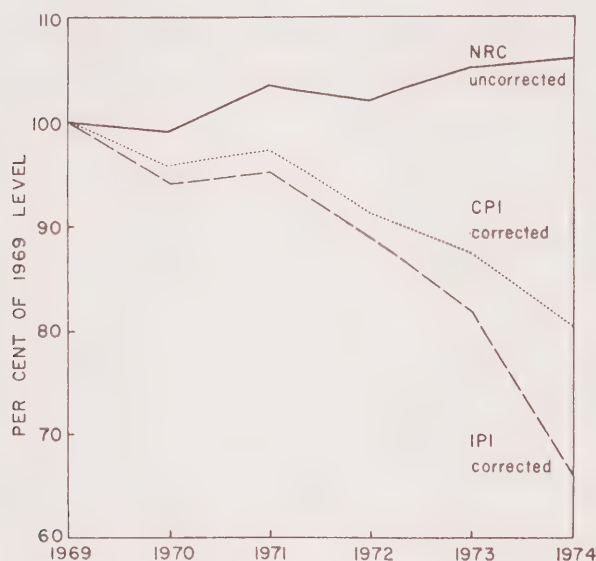


Figure 2. National Research Council of Canada, science research funding to universities expressed as a percent of 1969 level, and corrected for inflation using Consumer Price Index and Implicit Price Index. CPI and IPI courtesy Statistics Canada.

University support via the NRC has been reduced by one-third in the short period of five years. For purposes of calculating the effect of inflation,

the Implicit Price Index has been used. This measures the price of 300 goods and services and, in contrast to the Consumer Price Index, does not permit substitutions in the market-basket. There is no price index for science activities but probably costs rose more rapidly than IPI, in that science is both labour and energy intensive;<sup>7</sup> for example, the cost of organic chemicals rose up to 400% in 1974 alone.

The first obvious question is whether this decline in research support has occurred elsewhere. In this regard Fig. 3 reveals that Canada is alone among six industrial nations; that is the freezing of funding for research in science appears to be uniquely Canadian.

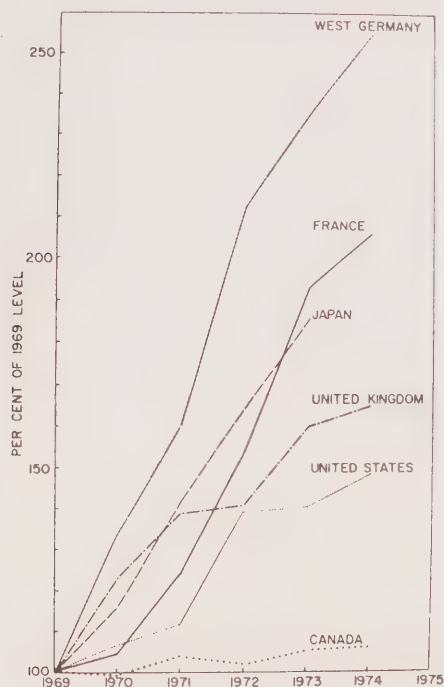


Figure 3. Support for university-based scientific research in six industrial nations.



Figure 3.

The data shown are for the largest single granting agency in each country which, however, represent a different fraction of total scientific research funding in each country.

Canada: National Research Council, Scholarships and Grants-in-Aid of Research Annual Reports 1969-70 to 1973-74; personal commun. 1974-75.

United States: National Science Foundation: about 40% of total budget is for university research grants. This can be separated in N.S.F. Annual Reports, 1969-73, but not in budget estimates ("Special analyses, Budget of U.S. Govt., Fiscal Year 1976") 1974-76.

Japan: Total science research and development funds to universities and colleges, but not including institutes or industry. Source: Japanese Embassy.

United Kingdom: Science Research Council: budget, including six research establishments takes up only a small part of the total science expenditure. Sources: Annual Reports of the S.R.C. 1969-74, and person. commun. British High Commission.

West Germany: Deutsche Forschungsgemeinschaft. This is a large, self-governing authority funded by the federal and state governments and by private donors. Ninety per cent of funds are for research support, the remainder for scholarships, travel and publications. Source: Tätigkeitbericht, and person. commun. Deutsche Forschungsgemeinschaft.

France: Centre National de la Recherche Scientifique. The Centre funds research in academic centres and in its own research institutes. Source: Rapport d'Activite and person. commun., French Embassy.

The second question is whether Canadian spending for research in universities was excessive to begin with, and thus has the federal policy merely brought Canada into line with other countries? This was the view expressed in Vol. 2 of your 1972 Report, in which you noted that basic research in Canada was 25% of total research and development and needed to be reduced to 10% in order to be consistent with other industrial nations.

Data from all reporting nations of the Organization for Economic and Co-operative Development<sup>8</sup> for 1971, (Table 1), reveal that the percentage support for basic research in Canada was consistent with that of other industrial nations, with the single exception of the United States.

TABLE 1. Basic research as a percentage of total R &amp; D.

Country	Per Cent Basic	Country	Per Cent Basic
Germany	26.9	France	18.5
Belgium	24.6	Spain	17.8
Portugal	21.8	Finland	17.5
Greece	21.9	Sweden	16.7
Canada	21.4	Italy	15.3
Denmark	20.7	U.S.A.	14.7
Norway	18.8	Ireland	9.8

Table 2, however, indicates that in terms of both absolute and per capita spending on basic research, the United States was the highest of any country. The reason for the lower per cent basic research in the U.S. was the enormous amount of applied and developmental research undertaken.

TABLE 2. Spending on R & D through higher education: ten nations ranked by expenditure.<sup>9</sup>

Country	1971 Spending for R & D in Higher Education (mil. \$ U.S.)	1971 Population (millions)	1971 Spending Per Capita (\$ U.S.)
U.S.A.	3,786	203.2	18.65
West Germany	859	59.4	14.55
Japan	752	103.7	7.30
France	433	49.8	8.83
Canada	312	21.6	14.85
United Kingdom	219	55.3	3.98
Italy	162	54.0	3.00
Netherlands	160	11.4	14.54
Sweden	124	8.1	15.50
Belgium	108	9.7	12.00

In retrospect the Senate Special Committee appears to have been too concerned with percentage in support of basic research, rather than the absolute level. This statistic (%basic) is especially inappropriate in the case of Canada, because the total research effort (expressed by R & D as % of GNP, Fig. 4) is small. The reasons for its small size are a function of the peculiar composition of the Canadian economy; the primary sector (agriculture, forestry, mining, steel, etc.), does little research relative to the value of the product; the secondary sector is disproportionately weak in the Canadian economy and much of its related R & D is done in the country of the parent-company; the service sector is large but the units are generally too small to attempt R & D. The overall effect of this is to give Canada an unusually low total R & D effort (Fig. 4).

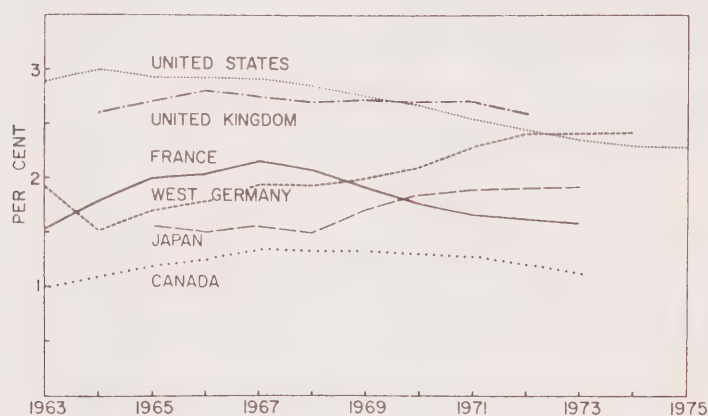


Figure 4. Research and development expressed as a per cent of

Gross National Product for six industrial nations. U.S. R & D expenditures do not include capital costs of facilities, but instead contain depreciation allowance. In recent years OECD has begun using GDP (Gross Domestic Product) in preference to GNP; R & D as a per cent of GNP had to be calculated from R & D as a per cent of GDP.

Sources: U.S. National Science Foundation; OECD; Statistics Canada

Your views and recommendations appear to have significantly influenced thinking, and led to similar reports being generated within Federal government departments. For example, "Science in a Changing Environment"<sup>10</sup> called for a reduction in funding of university research by Environment Canada, and a recognition of teaching as the only role of the university.

Your recommendation<sup>1</sup> for a reduction of basic research to only 10 per cent of total R & D by 1980 was consistent with the freeze in funding already in force for both the NRC intramural research laboratories and for the universities. In fact this level of 10% was unobtainable because of the expansion of basic research in federal laboratories (Table 3) which far exceeded 10% and is still rising.

TABLE 3. Federal government intramural research and development in the natural sciences<sup>11</sup>

Year	Basic Research (thous. \$Can.)	Total R & D (thous. \$Can.)	Per Cent Basic
1973-74	58,847	342,002	17.2
1974-75	65,841	377,696	17.4
1975-76	74,940	407,832	18.4



Thus the reduction in basic research in the universities, induced through reduced funding, has been more than made up by the increased funding for basic research carried out in federal laboratories. The universities now find themselves on a treadmill to oblivion. So great has been this shift (Fig. 5) that the objective of 10% basic research could now not be achieved even if all funding for university research in the natural sciences was stopped.

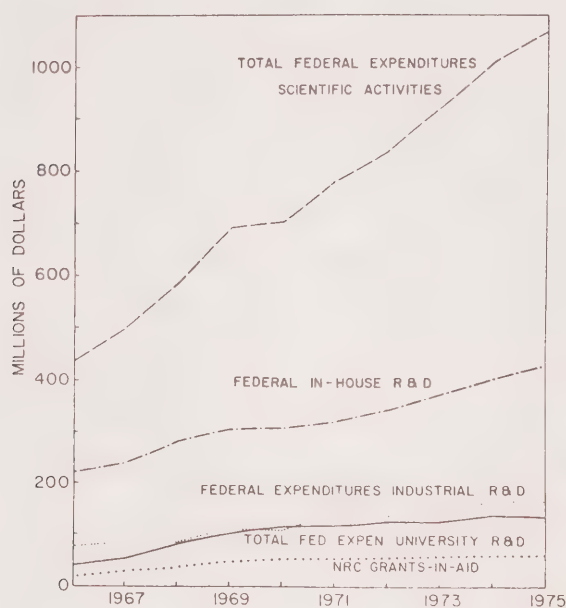


Figure 5. Comparison of federal expenditures on R & D by sector of performance. Source: Statistics Canada, Catalogue 13-202

In summary, the federal perception in the late 1960's that support for basic research in the natural sciences was excessive, was and is without foundation. The view that basic research should be reduced to 10% of R & D was, and is, ill-founded. As a consequence, Canadian universities have borne the brunt of illogical financial constraints imposed on research in the natural sciences, while federal intramural basic research in the natural sciences has steadily increased both in terms of total monies and as a percentage of total R & D.

B.) Undergraduate and Graduate Students in the Life Sciences

Over the 5 year period 1969-74, total undergraduate enrolment in Canadian universities increased by 19%, whereas that in Biology increased by 82%. To meet this unprecedented increase in student numbers in the biological sciences universities increased the number of full-time academic staff in Biology by 67%.<sup>7</sup>

It was a logical development that, over the same period, total enrolment in Canadian graduate schools also increased by 19%. However, in reverse of the overall trend, graduate enrolment in the Life Sciences actually decreased over the period 1969-73 by 8% to a total of 4,937, some 10.4% of the total graduate enrolment in Canadian universities.<sup>12</sup> The reduction in the number of graduate students being produced in the Life Sciences is the clearest possible warning that the research health of our university biology departments is in serious jeopardy.

We are aware that there are several reasons for the decline in graduate students in the life sciences, but undoubtedly, the major cause is the reduction in Federal support for university-based biological research.

Data released by the NRC <sup>13</sup> covering the period 1969-74, indicate that: a) the number of NRC Postgraduate Scholarships and Bursaries declined by 27.2% from 2178 to 1585; b) inflation and taxation (introduced in 1972) has reduced their net value from \$4,600 to \$2,590; c) the number of non-industrial NRC Postdoctoral Fellowships has dropped from 227 to 190. The NRC has recently (December 3, 1975) decided to reduce these further to only 100 -- a 66% decline!

The widely accepted myth of under-employment of students with post-graduate degrees receives no support from the information compiled by the Canadian Association of Graduate Schools, and should be discounted as a reason for declining graduate enrolment in Biology. In the 1974-75 academic year, over 96% of students completing their Ph.D. degrees had appointments at the time of submission of their theses.<sup>14</sup> It should also be noted that the number of doctorates awarded in the Life Sciences, i.e., by departments in Division IV as defined by the Canadian Association of Graduate Schools, dropped markedly (-20%) to only 330 in 1974-75.<sup>15</sup> This is equivalent to the 1971 production of doctoral students and is a direct consequence of the declining graduate enrolment in the Life Sciences noted above.

For the future, there are, therefore, very clear signs that recruitment of Canadian-trained personnel to the Life Sciences is not going to meet the demand that is anticipated. More importantly, the capacity for training such personnel also is being seriously eroded due to lack of research support to university biologists through the National Research Council.

John Porter *et al.*<sup>16</sup> have carried out a future study which indicated that in a post-industrial society the growth of knowledge and complexity

of technology would require numbers of specialists at the Master and Doctorate level similar to the Baccalaureate level in the present industrial society. As already pointed out by the BCC,<sup>7</sup> if the present trend in graduate enrolment in the Life Sciences in Canadian universities is not reversed, Canada will certainly not be able to satisfy the demands that will be made for biologists at that time.

C.) Research Support for University Biologists

The erosion in university-based biological research has recently been documented by the Biological Council of Canada. The situation has reached such a critical state that the Science Council of Canada has initiated its own study which will be published very shortly.<sup>6</sup>

To briefly re-iterate the stark facts: In 1969 the NRC awarded 927 research grants, at an average value of \$8,066, to university biologists. In 1975 1240 grants at an average value of \$9,623, were awarded. Over the 6 year period the number of awards increased by 34%, which is just over half the rate of increase of eligible biologists (c.f. 3b), whereas the average size of the grants increased by only 19%. Over this same period, the average rejection rate of biological applicants was 22% per annum. Even assuming that the 1969 average level of support per grantee in Biology was satisfactory (an assumption open to serious question and doubt) the 1975 average level of support should have been \$11,413 just to compensate for the effect of inflation over the past six years.

It must be recorded that, over the period in question, industrialists and scientists, through the NRC, did not successfully re-orientate the major thrust of the NRC Grants-in-Aid programme, either in terms of setting national objectives for science, nor by simply adjusting funding



to take into account the changing distribution of Canadian scientists. Thus, for example, between 1969 and 1975, the number of grants requested by university chemists decreased by 5% but the awards increased in average value by 35% to \$13,987. In 1975, Biology accounted for 28% of the 4413 successful NRC grantees, but only received 23% of the budget. Five percentage points is \$3.3 million which would have increased the average grant in Biology by 28% to \$12,284.

In aggregate, the differential between the physical sciences and the biological sciences, which amounts to several million dollars, has several profound effects on Canadian science. First, there is a direct effect on the supply of scientists at the doctoral level and their field of competence. There are over 1000 post-doctoral associates in the physical sciences supported through the NRC Grants-in-Aid: there are less than 200 in the biological sciences. Secondly, the differential affects the scale and level of research capacity in the discipline. Physical scientists are working at the level of atomic structure; biologists are still at the molecular level. Thirdly, there is the inter-relationship between a university scholar's research and teaching, already referred to in Section 2 of this Brief. The differential influences the education process, not only within the university but through the products of the university education system, so that the whole cycle becomes self-sustaining.

A second Canadian problem is the operating practice of the NRC and the MRC. Both agencies support an almost identical number of bioscientists (1100 each) but the MRC's budget for extramural research is four times greater than that of the NRC. This has led to significant but unwarranted differences in granting patterns between the two agencies.

A recent study of the Canadian Society of Cell Biologists<sup>17</sup> has shown that among colleagues of similar interests and needs, those supported through the MRC had grants twice as large as those supported by the NRC. Further, while the proportion of NRC grants over \$20,000 was only 15% of the total awarded, more than half of the MRC grants were over \$20,000 and 15% of them exceeded \$40,000.

This disparity is not peculiar to the group of biologists selected for the study cited. The Science Council,<sup>6</sup> selecting 1475 scientists in the fields of non-clinical physiology, biochemistry, nutrition, cell biology, genetics, microbiology and immunology, showed that of those supported through the NRC, 62% received grants less than \$10,000, 19% less than \$5,000, and only 8% received grants over \$20,000. Grants over \$30,000 were virtually non-existent. In contrast, only 14% of the MRC grantees received less than \$10,000 and nearly 25% of the grants awarded were over \$30,000.

D.) Federal Support for Research in the Life Sciences

Support for extramural research in the Life Sciences comes, in the main from both the National and the Medical Research Councils. The role of these Councils, and of other federal government agencies interested in biological research, is shown in the following table (Table 4).

TABLE 4. Federal Government Expenditures on Research in the Life Sciences, 1974-75 (including biology and clinical medicine) <sup>11</sup>

Department or Agency	Extramural University Sector (thous. \$)
Agriculture	600
AECL	202
Environment	1,569
IAND	222
IDRC	146
MRC	39,109*
National Defense	515
National Health & Welfare	13,172**
NRC	15,473
Supply & Services	18
TOTAL	71,026

\* One-third is classed as biology, one-third as clinical medicine and one-third as "other".

\*\* \$522,000 classed as biology, the remainder as clinical medicine.

Briefly, there are four points evident from the data presented: The first is that no less than 10 Federal agencies are involved in research support in the Life Sciences. Secondly, that extramural awards by the MRC account for 55% of the total expenditures; thirdly, that the disparity between extramural support for the medical sciences through the MRC and NHW and that for the rest of biology through the NRC is 3.4:1 in favour of medicine, and finally that extramural support from the departments of Agriculture and Environment is at ludicrously low levels. In the case of the latter ministry it is clearly implementing its own report "Science in a Changing Environment", recommending the relegation of our universities to a "teaching-only" role.

TABLE 5. Total Federal Expenditures on Activities in the Natural Sciences,  
by Departments.

Department or Agency	Total (thous.\$)	Extramural University sector (thous.\$)	Per Cent University Sector
Agriculture	89,389	1,110	1.24
AECB	10,391	10,375	99.84
AECL	102,297	769	0.75
CIDA	26,379	4,555	17.27
Communications	34,579	772	2.23
EMR	80,988	1,210	1.49
Environment	231,353	3,900	1.69
IAND	2,612	507	19.41
Ind. Trade Comm.	114,279	1,830	1.60
IDRC	10,805	292	2.70
MRC	43,816	40,424	92.25
Natl. Defense	83,445	3,341	4.00
Natl. Health & Welf.	31,362	14,268	45.55
NRC	163,127	65,892	40.39
Supply & Services	2,921	346	11.85
Transport	12,632	1,068	8.45
Other	21,540	000	0.00
TOTAL	1,061,915	150,659	14.19

The distribution of expenditures by the Federal Government in the natural sciences is shown in Table 5. Out of the total of \$1.06 billion only 1/7 th. was in the university sector and only 6% was awarded for research in the Life Sciences. We would suggest that the Senate Committee consider whether there are valid reasons for the relative lack of support for university-based research in the natural sciences in general, and specifically the implications of spending less than 7% for research in the Life Sciences.



Contract research for specific projects was originally intended as a partial substitute for the decline in extramural programmes. In fact, of the \$6 million worth of contracts awarded through the Department of Supply and Services to universities and non-profit institutions in 1974-75,<sup>6</sup> less than 10% went to biology departments, and none of this money went to unsolicited proposals covering projects identified by university biologists as having applied significance to the particular agency's mandate and goals.

The conclusion that seems inescapable is that the earlier warnings of the Senate Committee that increases in mission-oriented funding should not be at the expense of the traditional funding based on scientific merit and potential for fundamental discoveries, have been ignored or rejected.

The final point evident from the data in Table 5 is that if the extramural university sector only accounts for 14.2% of total expenditures, intramural government research must account for a large portion of the balance. This conclusion is supported by data published by MOSST<sup>18</sup> indicating that Federal Government intramural expenditures in the Life Sciences were 3 times greater than the level of extramural support, and that in biology (excluding agriculture and medicine) the disparity was 9:1 in favour of intramural research.\*

Drs. H.R.Wynne-Edwards and E.R.W.Neale have recently commented on the growth in government intramural research since the mid-sixties.<sup>19</sup> As they rightly point out, government science now makes a major and valuable contribution to the development of government science:

\* We have been unable to entirely reconcile the data published by MOSST<sup>18</sup> with that of Statistics Canada.<sup>11</sup>

*"but for government to point to increased expenditures for science as a sign of the health and well-being of Canadian science is not good enough if these increased expenditures take place only within the government."*

That is the problem, because as the above data clearly indicate, research growth in the Life Sciences in recent years has been very largely confined to within the government. This growth must be more evenly divided between industry, the universities and government.

There is also one fundamental difference between extra- and intra-mural research programmes. With very rare exception the former are all based on a genuine peer-review system. It can fairly be said, and defended, that the NRC and MRC are not supporting any second-rate researcher, trying to tackle some trivial problem. The projects have been evaluated; the investigator has been judged. In the latter case there is also an international component, in that a researcher's previous success can be measured in terms of scholarly publications. These, in turn, even in the case of Canadian scientific journals, are reviewed by internationally recognized authorities. Thus, the university sector can be expected to be more productive of good research, per dollar expended, than government services.

Drs. Wynne-Edwards and Neale advocate that the peer-review system evolved by the NRC and MRC and now also used by the American National Science Foundation, should be the basic means of allocating the R & D budget both within and outside the government.<sup>19</sup> There are, of course, problems in applying peer-review to mission-oriented programmes, but we feel that they are not unsurmountable, and that the proposal for a modified peer-judgment system applicable to each mission should be given very careful consideration.

## 4 "TOWARDS THE EIGHTIES" -- POSSIBLE CHOICES

The case already has been made by both the Biological Council of Canada<sup>7</sup> and the Science Council of Canada<sup>6</sup>, that funding for basic biological research in Canadian universities has been, and is inadequate to maintain the necessary rigour for high quality work. The current marginal levels of financial support foster artisanal research concentrating on problems which can be solved cheaply rather than investigation of problems which are important. This, in turn, leads to the production of future Canadian bioscientists whose training has been inadequate, who are not experienced with experimental hardware common in biological laboratories outside Canada, and who have not had the opportunity to develop their scientific intellect to its potential.

The present serious situation can only be remedied by a substantial increase in the financial support for basic biological research, now funded chiefly by the National Research Council. Without increased funding less than 400 biological research programmes throughout the whole of Canada could be funded by the NRC at an adequate, but certainly not generous, level of support.<sup>6</sup> This would be equivalent to cutting off two-thirds of the current grantees, and leave far too small a base for continued work on the myriad of problems constituting Canada's research needs in biology. The Biological Council of Canada<sup>7</sup> suggested a basic budget for NRC supported biological research of \$18.5 million for 1976-77. This budget was based on (i) a partial correction of the peculiarly Canadian discrepancy between research support for the physical and for the biological sciences, (ii) a slight growth in number of grants (universities are still increasing the size of their Biology departments because of student demand), (iii) a 10% annual inflation factor.

The Science Council<sup>6</sup> arrived at a similar figure of \$19.9 million for 1976-77 based on allowances for inflation, increase in numbers of grantees, and the need to provide heavy equipment for biological laboratories.

The two budgets proposed have no novel components in them, but it must also be pointed out that the research climate in Canadian universities has changed significantly over the past 5-6 years. Provincial support for universities has not increased at the same rate as inflation and university growth, so that the universities today do not have the financial resources to equip new staff members nor augment the sums awarded by the NRC or MRC.

These 1976-77 "remedial" budgets, approximately 60% higher than the amount of money currently allocated to Biology through the NRC, are consistent with the 1980 goal of \$45 million (= \$50 million taking inflation into account) proposed by Larkin and Stephen.<sup>20</sup> We are already halfway to the target date, but only one-quarter way to the target budget. In isolation the increases now deemed necessary seem massive. However, it should be remembered that it is the neglect of the Biological Sciences during the past 6 years which created this situation. It should also be borne in mind that the increased remedial funding represents a very small percentage of the total R & D budget of the Federal Government; for example, a 10% transfer from intramural expenditures for Biology to extramural grants would be equivalent to a 100% increase in NRC support for Biology.

The major concern is to ensure the most effective use of Federal monies for biological research, whether it be basic, applied or developmental. As part of the arrangements to meet this concern, there should be a continual dialogue between the major biological societies of Canada,



represented almost entirely by the Biological Council of Canada and the Canadian Federation of Biological Societies, the granting councils concerned, other Federal Agencies supporting extramural activities, and perhaps, most importantly, the Ministry of State for Science and Technology.

It is therefore, with considerable regret that we have watched MOSST, under three successive Ministers, of which the present is only part-time, become increasingly less effective in acting as the essential cohesive force in both initiating and responding to the goal of a science policy for Canada.

The most attractive alternative to maintaining the status quo is a re-activation of MOSST's original goals, with the authority from Cabinet to instruct other ministries on appropriate goals and expenditures on research investigations in previously determined areas of importance. The recent admission by MOSST that it was not aware of all areas of scientific research currently being investigated by government agencies -- a situation hardly surprising in view of the number of agencies involved -- emphasises the need for Cabinet approval of an over-riding authority for MOSST. It would be the responsibility of MOSST to ensure that university-based scientific research, particularly in the Life Sciences, was fostered, and adequately funded. This would involve not only investigations in basic Biology but also in applied and developmental areas. It is important to synergise the research potential of Federal laboratories and the universities. MOSST should also strongly pursue their current futures study on the numbers and areas in which trained scientists will be required in 10-20 years' time. A mechanism should then be found to give some control over the number of graduate students trained, while allowing maximum flexibility to both

supervising professors and the potential students. A key element might be that 90% of all graduate students must have obtained a post-graduate scholarship, tenable in the laboratory and university of their choice, coupled with a modest research grant. Operating grants for principal investigators would then be divorced from graduate student support. The remaining 10% of graduate enrolment would allow university professors to accept students whom they believed in but who had not received a national scholarship.

As part of the upcoming federal-provincial discussions on cost-sharing for our universities, consideration should be given to the provincial responsibility for supporting university scholarship. As we have already argued, university scholarship encompasses both teaching, learning and research. They are inseparable components in the life of every university professor, and should be recognized as such. In this regard the French model might be considered, namely that by virtue of a university professorial appointment, the university (and the province) accepted the responsibility of providing modest financial support to enable the professor to pursue his scholarly duties. Additional funds, solely on the criteria of excellence applied to the proposal and to the professor, would be awarded from one of the national granting councils.

Introduction of such systems for both graduate work and research, and guidance of the research goals of individual universities, would also solve one of the major problems currently facing the NRC, namely supporting university-based research programmes in animal sciences, forestry, kinesiology etc., which were, and probably still should be funded by the departments of Agriculture, Environment, National Health and Welfare, etc.

It goes almost without saying, that the oft-delayed new granting councils should be established as a matter of urgency. The present uncertainty is severely detrimental to future planning for Biology in particular, and science in general. The new Natural Sciences and Engineering Research Council will have to preside over, and direct the inevitable and necessary changes in Canada's science policy. Applied sciences, such as Biology, must be promoted. This can easily be done by ensuring that the composition and terms of reference of the NSERC reflects the importance of disciplines such as Biology. It is worth noting that although Biology accounts for 28% of the entire NRC Grants-in-Aid programme, there has usually only been one, and sometimes two, biologists appointed to the Council itself.

It is equally important that the individual councils should have a direct voice at the Cabinet level, so that all matters affecting Canadian science may be argued and forcibly represented, as is now the case in the applied areas of medicine, agriculture, fisheries, etc. What is currently so illogical is that the area of basic scientific enquiry, upon which ALL applied and developmental work rests, is the one area neither directly represented, nor heard, when the specialized applied areas have their own influential support.

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## Appendix "47"

Canadian  
Biochemical SocietyLa Société Canadienne  
de Biochimie

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December 8, 1975

Senator Maurice Lamontagne  
Canadian Senate Special Committee  
Science Policy  
The Senate Canada

Dear Senator Lamontagne:

Re: Forthcoming activities planned by the Canadian  
Senate Special Committee on Science Policy.

On behalf of the Canadian Biochemical Society I should like to thank you for your letter of October 14, informing us of the progress your committee on Science Policy has made, and permitting us to participate in the formation of science policy in Canada.

This very short brief derives from the immediate considerations of myself, as Chairman of the Canadian Biochemical Society, and Dr. David MacLennan who is Chairman of the society's Science Policy Committee. It should however be considered as a compilation of many hours of thought and discussion by Canadian Biochemists and Bioscientists from right across Canada. As you will understand, Science Policy has a very profound impact on the contribution that we as scientists make to Canadian life. In groups, at many, many meetings, we have discussed it over and over again.

1. The Future Research Program

One of the major declarations which issued from the Lamontagne Reports echoed the desire of Canadian Bioscientists i.e. the need and obligation to participate in the formulation of Science Policy in Canada. Since 1969 we have seen the structures for this participation being built through the Medical Research Council, the National Research Council, Canadian Federation of Biological Societies, SciTech and most important through MOSST. Unfortunately the MOSST developments appear to have come to a halt. It is not clear what then is to be the major stable formal link between Canadian Scientists and the Science Policy forming structure of government.

One would hope that the Institute for Research on Public Policy and the Canadian Research Board would have scientists on its board and that the various scientific bodies (both individual, like the Canadian Genetics Society, and umbrella, like the Canadian Federation of Biological Societies) will be invited to participate actively in the formulation of Science Policy. Each society has a publication, through which the deliberations of the Institute and the Board could be made available to all Canadian Scientists.

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## 2. Systematic Review

We commend the Senate Committee on its initiative in monitoring a review on the implementations of their initial reports. There are many areas which have in fact received little or no help. Some of these are noted below.

## 3. Criteria to Assess and Review Science Policy

As noted under 1. the MOSST developments, which were initially to have involved Canadian scientists at many levels, appear to have faltered. We therefore welcome an open, critical assessment of its original intent and how the purposes set out may best be achieved.

### Developments Since 1969. I. Science Policy Formulation

The Canadian Biochemical Society is not now in a position to submit a major formal brief. Much of what was contained in the original brief of 1969-70 is valid, although it is now clear that there is greater appreciation that Canadian Scientists as a group must have significant input to the formulation of science policy.

Let me review the developments since 1969-70, as they affect the Canadian Biochemical Society, but also all other scientific societies in Canada. Few, if any, positive changes in science policy formulation as they affect the basic scientists, have occurred since then. The various emerging positive developments, which centred around MOSST, SciTech and HOST have now receded almost out of sight.

What we have been left with are the negative developments. These are reflected in a faltering system whereby the scientific community has no direct input into developing science policy in Canada; and in reduced support for basic biological research performed in Medical Schools and in Biology Departments of Universities across Canada.

Positive action on the part of Bioscientists in developing science policy have occurred. Thus the Canadian Biochemical Society, like others, has its own Science Policy Committee. The committee sits in conjunction with others at the Science Policy Committee of the Canadian Federation of Biological Societies. This committee has been very active in attempting to develop priorities and to interact with government to assess the impact of implementation.

In Ontario we have formed the Association for the Support of Medical Science. It is a broad-based organization drawing not only on biochemists, but on all bioscientists. Again the purpose is to develop science policy and to provide interaction with both provincial and federal governments.

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Unfortunately we have not been able to establish formal, effective interaction with government agencies devoted to development of science policy in Canada.

## II. Funding of Biological Science Research

A second major problem which has been clarified since 1969-70 is that biological research is not adequately funded. This is true for that research being carried out in Medical Schools, generally funded by the Medical Research Council. It is even more evident for that research performed outside the medical schools and supported primarily through funds provided by the National Research Council.

### (a) NRC-Funded Research

The Science Policy Committee of the Canadian Federation of Biological Societies in association with the Science Council, has prepared a position paper on NRC - funded research. This document will be forwarded to you directly. It of course represents the views of the Canadian Biochemical Society. Here follow the major conclusions of the report.

### A National Statement on Basic Biology

#### Tomorrow's Biology

#### The Case for Basic Biological Research in Canada

#### Summary

##### 1. Introduction

The purpose of this Statement is to reveal the current inadequate level of funding of basic biological research carried out in departments of biology at Canadian universities, and to recommend relief from the consequences.

As a scientific discipline, biology is central to the resolution of a host of contemporary and future human problems. To fill this mission, biology must be sustained by basic research, a major portion of which is performed in university faculties of science. The principal source of financial support for these endeavours is the extramural grants program of the National Research Council, particularly the operating and equipment grants awarded to individual members of faculty. After years of short funding this program is far from meeting its full potential for production of new information and of trained personnel.

##### 2. Recent Trends

The purchasing power of operating and equipment grants in biology has been severely eroded since 1969. For six years prior to that date, the average individual operating grant increased from some \$6,000 to \$8,000, just keeping pace with the increased cost of research. Between 1969 and 1974 only \$500 was added to the average grant. These meager increases did little to stave off the steady erosion in effective value of most grants. It has been calculated that a 1974 operating grant would buy 41% less research than a 1969 grant.



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This year the National Research Council, despite its perennially inadequate budgets, offered some respite in this steady decline with an increase to about \$9,600 in the average operating grant. However, in biology this was in large part possible only at the expense of equipment budgets which have been more than halved in six years, during which the dollar cost of apparatus had more than doubled. Consequently, for seven years, only one in twenty successful grantees could acquire a piece of major equipment each year, scarcely enough to cover the addition of new applicants without allowing for replacement, modernizing or adaptation to new research enterprises by continuing grantees.

### 3. Current Needs

A proposed model budget suggests that a typical grant for a fully-trained biologist starting independent research in a Canadian university should approach \$10,000, and yet 62% of all grantees in biology received less than this amount in 1974. This sum would cover only research supplies, equipment, travel and service needs. If an investigator were sufficiently productive to warrant continued support, the needs would expand to include support for assistants and professional associates, requiring doubled or trebled grants to a progressively smaller number of grantees. For the select few who attain an internationally recognized level of research, a budget of \$60,000-\$100,000 annually would not be exorbitant. Yet only 2% of the grants in biology awarded by the National Research Council in 1974 exceeded \$30,000 and none exceeded \$50,000. Consequently, even the top-quality bioscientists in Canadian universities have been unable to achieve their full potential, whatever the merits of their projects. A redistribution of current budgets to provide fewer, larger grants could be achieved only by rejecting two-thirds of the applications outright. The 800 disappointed grantees would include many new, untried applicants, and a host of productive bioscientists representing many essential facets of the diverse biological discipline. The needed breadth and flexibility can only be achieved by a major increase in the budgets of the N.R.C. grant selection committees for biology.

If, as a start, one accepts that the relative status of biological research budgets in 1969 was not excessive, a mere updating which corrects for seven lean years gives a 1976 Remedial Budget for basic biology of \$19.9 million. To this we recommend the addition of \$1 million to support full-time post-doctorate research associates in university biology departments so that we may better utilize the wealth of talent now available and nourish that resource for our future needs.

These increases would markedly improve the average grant, but to obtain the ideal breadth of support from the novice up to the leader of international stature, a Target Budget for 1976-77 would require \$30 million. If such a goal is postponed, the eventual cost of a program of this scale will increase apace with inflation and the growth of the discipline, as it follows the demands of society. The sooner these goals are appreciated, the surer Canadians may be of anticipating and avoiding biological crises related to the quality of our lives.

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4. Key Recommendation

That an immediate remedial budget of \$19.1 million be given urgent consideration; that serious consideration be given to the funding of post-doctorate research associates on large research teams to promote the development of basic biological research goals of recognized priority; that recognition be given to an eventual target of \$30 million for basic biological research in universities.

(b) MRC-Funded Research

We wish to make three major points with respect to biomedical research, i.e. biological research performed in medical schools and health-related institutes or faculties.

1. Biomedical research is not adequately funded; 2. There is a disparity in the level of research funding for biomedical research by different Federal Agencies; 3. Biomedical research is being increasingly restricted as medical school budgets are constricted by provincial governments.

The Medical Research Council is the largest contributor of funds for basic research by members of our society, and for biomedical research across Canada. The Medical Research Council has, in our opinion, provided superb leadership in the development of biomedical research in Canada. Since the organization of this Council is well known to you, we will not elaborate on its achievements but we would like to point out that it is clearly carrying out a policy of support for work of high quality as suggested by your summary recommendations 10 through 13.

Over the past several years the MRC budget for supporting research has diminished in real dollar value, particularly in the last 3-4 years. The crisis point was reached in 1974 when biomedical research workers were forced to protest the loss of purchasing power in research budgets. A statement on the need for immediate increases in research funding was prepared and presented to the honourable Marc Lalonde, Minister of Health and Welfare. A copy of this statement is enclosed for your committee. While the MRC budget was increased in response to this protests, it was cut back in June 1975, and the present state of the budget of the MRC is not known to our membership.

It is clear from data presented in the statement that biological research generally and biomedical research in particular, is not being adequately supported. It is also clear that among the long term consequences is a decrease in the number and quality of young people entering the field of biomedical research. Already the number of medically-trained people entering research has dropped sharply. In any projections of the future attention must be paid to the training of young people entering the research area.

Finally, we would point to a crisis in University funding at the Provincial level which is causing severe restrictions in Departmental budgets of medical, as well as basic science faculties throughout the country. In an atmosphere where service in the form of teaching must be preserved, research is jettisoned first. The erosion of research support in Universities is

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underway and this does not bode well for future research in Canada. The serious decline in teaching and in research in Canadian universities will have a profound long-lasting effect on the intellectual and practical contributions that Canadian scientists will be able to make in the future.

At this critical point we would emphasize once again the very great need for the direct involvement of Canadian scientists in the development of science policy in Canada. The Canadian Biochemical Society will participate fully at every possible level. We hope your Committee will call on us and all other scientific societies to do so.

Sincerely yours,



Rose Sheinin, Ph.D.  
Chairman, Canadian Biochemical Society

RS/cb

cc Dr. D. MacLennan  
Dr. G. Setterfield  
Dr. J.M. Neelin









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Government  
Publications

FIRST SESSION—THIRTIETH PARLIAMENT  
1974-76

THE SENATE OF CANADA  
PROCEEDINGS OF THE  
SPECIAL COMMITTEE OF THE SENATE ON  
**SCIENCE POLICY**

The Honourable MAURICE LAMONTAGNE, P.C. *Chairman*

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Issue No. 25

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THURSDAY, SEPTEMBER 9, 1976

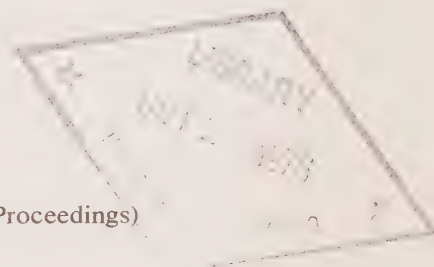
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**Twenty-fifth Proceedings on**  
the Study of Canadian Government and  
other expenditures on scientific activities  
and matters related thereto.

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(Witnesses and appendices: See Minutes of Proceedings)



THE SPECIAL COMMITTEE OF THE  
SENATE ON SCIENCE POLICY

The Honourable Maurice Lamontagne, P.C., *Chairman*

The Honourable Donald Cameron, *Deputy Chairman*

AND

The Honourable Senators:

Asselin	Hastings
Bélisle	Hicks
Bell	Lang
Blois	Manning
Bonnell	Neiman
Bourget	Riel
Buckwold	Robichaud
Carter	Rowe
Giguère	Stanbury
Godfrey	Thompson
Goldenberg	van Roggen
Grosart	Yuzyk
Haig	

27 Members

(Quorum 5)

# Order of Reference

Extract from the First Report of the Special Committee of the Senate on Science Policy, presented on July 10, 1975 and printed as an Appendix to the Minutes of the Proceedings of the Senate of that day, and adopted by the Senate on July 24, 1975:

"The Committee, therefore, recommends that it be authorized to consider and report on Canadian government and other expenditures on scientific activities and matters related thereto;

That the Committee have power to engage the services of such counsel and clerical personnel as may be necessary for the purpose of the inquiry;

That the Committee have power to send for persons, papers and records, to sit during adjournments of the Senate and to report from time to time; and

That the Committee be authorized to print such papers and evidence from day to day as may be ordered by the Committee."

Robert Fortier,  
*Clerk of the Senate*



# Minutes of Proceedings

Thursday, September 9, 1976  
(39)

Pursuant to adjournment and notice the Special Committee of the Senate on Science Policy met this day at 9:35 a.m., the Chairman, the Honourable Senator Lamontagne, presiding.

*Present:* The Honourable Senators Bell, Carter, Godfrey, Hicks, Lamontagne, Lang, Stanbury and Yuzyk. (8)

*In attendance:* Mr. Philip J. Pocock, Director of Research and Mr. Jacques W. Ostiguy, Chief of Administration.

The Committee resumed consideration of its Order of Reference dated July 24, 1975 relating to the study of Canadian Government and other expenditures on scientific activities and matters related thereto.

The following witnesses were heard:

*From: The Canadian Council of Urban & Regional Research*

Professor Meyer Brownstone, President;

Mr. Serge Boucher, Vice-President;

Mr. Vernon Lang, Executive Director;

Mr. Hans Blumenfeld;

Mr. Robert Cournoyer;

Mr. John Hitchcock.

*Social Science Research Council of Canada*

Dr. J. J. Loubser, Director.

*Humanities Research Council of Canada*

Dr. David Steedman, Academic Director;

Mr. Pierre Savard, Past Chairman.

*Canadian Political Science Association*

Professor Hugh Thorburn, President-Elect,

Professor Conrad Winn,

Secretary-Treasurer.

On Motion duly put it was *Agreed* that the brief presented by the Canadian Council on Urban and Regional Research; the brief presented by the Social Science Research Council of Canada together with a statement on the Crisis in Social Science Research Funding approved by the Council on June 6, 1976; the letter dated March 4, 1976 addressed to the Honourable Senator Maurice Lamontagne by Mr. John Banks, Executive Secretary of the Humanities Research Council of Canada be printed as appendices to this day's Minutes of Proceedings and Evidence. (See appendices Nos. "48", "49" & "50").

Professor Brownstone, Dr. Loubser, Mr. Boucher, Dr. Steedman and Professor Thorburn each made an opening statement. The witnesses then answered questions put to them by Members of the Committee.

At 12:47 p.m., the Committee adjourned until 2:30 p.m., Thursday, September 9, 1976.

ATTEST:

Patrick Savoie,

Clerk of the Committee.

# The Special Committee of the Senate on Science Policy

## Evidence

Ottawa, Thursday, September 9, 1976.

The Special Committee of the Senate on Science Policy met this day at 9.35 a.m. to consider Canadian government and other expenditures on scientific activities and matters relating thereto.

**Senator Maurice Lamontagne** (*Chairman*) in the Chair.

**The Chairman:** Honourable senators, this morning we have three main organizations. One is part of another, and has accepted our invitation to be present this morning. We have the Canadian Council of Urban and Regional Research, the Social Science Research Council of Canada, the Humanities Research Council of Canada, and the Canadian Political Science Association, which is part of the Social Science Research Council of Canada.

I propose to invite the main spokesmen to make short opening statements. Perhaps at the beginning of the question period we could concentrate on the brief of the Canadian Council of Urban and Regional Research because it is more restricted in scope, and then devote the major part of this morning's hearing to the other briefs.

In terms of briefs and printing, I would suggest that we print the brief that we have received from the Canadian Council of Urban and Regional Research, and the brief we have received from the Social Science Research Council of Canada. This second brief is a joint presentation and it is supported by the Humanities Research Council of Canada and, also, as a matter of course I suppose, the Canadian Political Science Association. In addition I would propose to print a letter which was addressed to me by the Humanities Research Council of Canada dated March 4, 1976, and a letter from the Canadian Political Science Association. It is also suggested that we should print as an addendum to the brief from the Social Science Research Council of Canada a statement entitled: "Statement of the Crisis in Social Science Research Funding", approved by the council at their last meeting on June 6, 1976, held in Quebec city. It is a very short statement. It does not add very much to the main statement, but it represents a more recent view of the situation.

*(For text of briefs and letters, see Appendices pp.28-55)*

We will now hear the opening statements. I would ask each spokesman to introduce the members of his own delegation, if any.

**Professor Meyer Brownstone, president, Canadian Council of Urban and Regional Research:** I would like first to express the appreciation of the Canadian Council of Urban and Regional Research for a second opportunity to discuss science policy with you, the application of science to urban policy problems or the urban condition in general.

I shall now introduce the members of our delegation. With me today are Mr. Serge Boucher, Vice-President and a development organizer for the Laurentide Regional De-

velopment Council; Professor Leslie J. King, Dean of Graduate Studies at McMaster University and a geographer; Mr. Robert Cournoyer, a former executive director of the council, and presently Director of Research and Development in the Planning Branch of the Quebec Department of Municipal Affairs; Professor John Hitchcock, the Associate Director of the Centre for Urban and Community Studies at the University of Toronto; Mr. Vernon Lang, our present Executive Director; and Professor Hans Blumenfeld, who is a fellow of the Institute of Planners, a distinguished international planner who from time to time teaches at the University of Toronto.

Mr. Chairman, it has been some seven years since our predecessors on the council appeared before you. Since that time much has happened on the urban front. I must report, unfortunately, that our ability to study urban problems and to develop urban policies through research, which of course is our main interest, has not improved in those seven years. This is despite the creation of a number of new institutions in Canada, including the Ministry of State for Urban Affairs, whose mandate is specifically to deal with the urban condition and to develop adequate policy to deal with the urban situation.

The council itself, in those past seven years, has been very busy spending research funds which initially came solely from the Ford Foundation. As you will note from our earlier brief those funds later came from federal government, the Ministry of State for Urban Affairs.

I am not going to review our previous submission. I really want to mention events that occurred between that writing and the present time. The members of the committee may be aware that unless something happens very quickly this is the wind-up year for Canadian Council of Urban and Regional Research. After 15 years of governmental support we are now faced with the systematic winding up of our affairs in the current year. We are endeavouring, Mr. Chairman, to perpetuate the influence of what we have done, rather than our institution. We are all determined to support, encourage, induce, and coerce the continuation of the activity which our council has carried on over the last 15 years, and not simply attempt to maintain ourselves.

During this period we have been dealing, I hope, constructively with our outstanding research commitments. We have in this present research year mounted a series of regional forum discussions around the theme of land management. This is typical for the council. Although we are not engaging in new research, we are reviewing the state of the art in this field. We are trying to encourage a policy discussion throughout the regions of Canada, based on the regional perceptions of that particular problem. We also are very busy trying to find new homes for some of the activities which the council has generated and the membership of the council feels should be continued.

Basically these are two in kind. The first is our bilingual publication which is called *Urban Forum: Colloque Urbain*, and the second is *Urban & Regional References: References Urbaines & Regionales*. Both of these we are trying desperately to have maintained. If the council does disappear at the end of this year, we would like these two activities to continue. As a matter of fact, there is a meeting later today to discuss some consortium arrangement to maintain *Urban Forum*.

**Senator Hicks:** May I interrupt to ask Professor Brownstone to tell us how frequently *Urban Forum* and *Urban and Regional References* are published?

**Professor Brownstone:** *Urban Forum* is published quarterly; *Urban & Regional References* is published once a year.

**Senator Hicks:** The one before us is dated 1973.

**Professor Brownstone:** Yes.

**Senator Hicks:** That is the last one, is it?

**Professor Brownstone:** No, it is not the last one. The 1975-76 issue will be off the press this week.

With regard to *References*, we are actively negotiating the maintenance of that service and there appears to be some chance that we will receive at least initial funding from the Ministry of State for Urban Affairs, but this is by no means settled as yet.

Mr. Chairman, if I may comment briefly on the whole question of the state of urban research in Canada I will do it briefly and to the point if I refer the members of the committee back to our original brief and to our comment in it regarding the fate of a number of recommendations made by this particular committee with regard to research in Canada.

On page 4 of that brief we note that, contrary to the spirit of the recommendations of this committee, the present outlook for urban research in Canada is, in our view, poorer than it was when you made them. If you like, Mr. Chairman, I can review very quickly some of these recommendations and indicate to you that, indeed, the outlook for urban research is much poorer now than when you initially made those recommendations, or I can wait for a later point.

**The Chairman:** Perhaps there would be a duplication. It would be better to go over your recommendations one by one during the question period.

**Professor Brownstone:** Mr. Chairman, I will conclude very briefly. I wish to underline the interest which the council has in appearing here today. It is basically twofold. First of all, it is to bring before the committee and to discuss with it what we consider to be a crisis in an important area of science policy—the whole area of urban policy. Part of this crisis is due to a continued lack of adequate attention, and concerned systematic attention, to the whole area by the institutions affected by urban policy and the institutions responsible for developing urban policy. In this we include governments at various levels and the private sector—and we do not leave out the universities as responsible bodies in this particular area. We feel that, despite the continued urban crisis as such, we have not really done an adequate job of maintaining our knowledge base, communications base and our ability to cope effectively with the urban situation in Canada.

Our second purpose is to discuss with the Senate committee the possibility of the continuation of the activities of the Canadian Council of Urban and Regional Research which we regard as an important and useful factor in the development of urban policy and the improvement of our urban situation in Canada. Our main concern is not to preserve institutions as such, as most institutions tend to become, or may become, irrelevant over time, but the activities which we have been performing we regard as essential, and we consider that their continuation is vital to the effective development of urban policy in Canada.

As far as we are concerned as a council, an institution or an activity such as ours is important, based on several criteria, which criteria I am sure can be shared by other institutions in the area of the social sciences. Our first criterion is that of independence. We do not mean irresponsibility, but independence. By independence we mean independence of the constraints of particular institutions whether they be government, university, or the private corporation. In order to evaluate, to communicate and to innovate effectively, we need an institution, an activity, in Canada which is free of the constraints of particular institutions, which by definition are bounded by their own jurisdiction, by their own mandates or their own traditions.

A body such as the Canadian Council of Urban and Regional Research, with an open membership, is not similarly constrained, although it embraces in it the activities of the people involved in their separate institutions. We were at one time a federation of institutions, but we are now an open membership body, in which membership is available to every interested person for a membership fee and a subscription. So that the first important criterion for our kind of contribution to the development of urban policy is independence, for the reasons cited.

The second criterion is that of competence, and although the Chairman is quite correct in saying that our council has a more limited activity than the other bodies represented today, within those limitations we operate in an extremely complex field, known in Canada as the urban field which, indeed, employs most of the disciplines and much of the interest in the policy of Canadians on a very wide range. We therefore need the highest level of competence in this particular field in order to be effective advisers to the development of policy, and to make ourselves effective to deal with the urban environment. So our kind of competence requires not simple but diverse competence, and over the years I think the Canadian Council has been an outstanding example of the ability of a range of diverse competencies to work, focusing on the urban situation.

A third criterion is, of course, that of relevancy, and particularly when we pretend to deal not, perhaps, with basic aspects of science, but with applied aspects also. When we use a term like policy, then clearly we are working in an applied area and relevancy becomes a very important criterion. An institution such as the council provides an interface between all that is relevant in urban policy. By that I mean in terms of our research interest, the providers of research, the research workers, research procedures, research users and, another important element in research in Canada, the research resource function or group.

From the beginning CCURR has attempted to function as an interface between these components of research and public policy. It has provided this through membership initially, through its institutional membership and, second-



ly, through, more latterly today, an open membership. One of our prime objectives has been to provide that kind of interface between users and producers of research and providers of research resource. We have done this through our publications and bibliography. We have done this through a continuous process of seminars, workshops and public sessions of one kind or another dealing with the urban problem.

I would certainly urge the committee to give consideration to these kinds of criteria and to the ability of an organization such as the Canadian Council of Urban and Regional Research to meet these criteria and to contribute effectively to the development and use of knowledge in developing urban policy.

In closing, Mr. Chairman, allows me to stress as a personal note after many years of experience on the council itself, as an active practitioner in municipal affairs in the province of Saskatchewan some years ago, as a teacher in the local government field and an active researcher and consultant on local government matters, largely now in the urban field, that we are a long way from solving the problem of developing effective urban policy in Canada. There are great gaps in our knowledge, brought about partly by our failure to organize ourselves institutionally to deal with and develop knowledge, and partly by the continued problem of trying to focus a number of political jurisdictions and groupings on a single entity known as the urban situation. It is my conviction that a body such as the Canadian Council of Urban and Regional Research can help to deal with both problems, not simply the development of knowledge and its dissemination, but also its ability to transcend the very difficult areas that tend to continue to exist between jurisdictions.

With your indulgence, Mr. Chairman, I should like to ask that our vice-chairman, Mr. Serge Boucher, be heard for a few moments as well.

**The Chairman:** Certainly.

[Translation]

You can move up to the microphone, Mr. Boucher.

**Mr. Serge Boucher, Vice-President, Canadian Council on Urban and Regional Research:** Thank you, Mr. Chairman. Honorable Senators, I will try to be as brief as possible. I would simply like to add a few words to what the Chairman of the Canadian Council for Urban and Regional Research has said.

First, as he has mentioned, the Canadian Council on Urban and Regional Research has recently broadened its base. It has recruited members from all sectors of activity related to urban affairs, outside of the research field as such. It has, so to speak, brought together or tried to bring together the producers of research and its consumers.

Within the Council, I tend to represent the second category, that of the consumers. At the last annual meeting of the Council, we expressed our distress at the thought that most of the funds available for urban and regional research will, in the future, be in the hands of the Department of Urban Affairs and that there will be less diversity than before. We believe that an independent, professional organization, as has been mentioned, must be able to control a certain portion of the funds available for urban research and to allocate them as it sees fit, especially to innovative projects which are not attractive in the short run, but could prove very profitable in the long run for our

society and cities and provide encouragement for researchers who, in some cases, because they are just beginning and are relatively unknown, are not easily accepted by highly structured organizations having close long-standing ties with the "Establishments", so to speak, of academic research.

I would now like to illustrate what I have been just saying. The council which I head—le Conseil régional de développement des Laurentides—north of Montreal, would like to do research on human occupancy of the vacation area known as the Laurentians and the types of occupancy that would be most compatible with the natural milieu which makes the region valuable and attractive. By natural attractions, I mean rivers, lakes, etc. At the moment, the council's main worry is that the human occupancy of the Laurentians will take place in the same way as it is taking place, in the suburbs surrounding Montreal, where natural resources are being completely and systematically destroyed, as they have been in the city itself.

Now, if the Department of Urban Affairs or the Department of the Environment do not have the same preoccupations as we do in terms of development and the search for new types of development, to whom are we to turn? I am convinced that an independent organization with more limited funds than the existing Departments or Science Councils, an appendage of the governmental apparatus, could be useful in recognizing the long-term value of projects. Thus, I think that the experience of the Canadian Council on Urban Research, in which I have participated since the Council broadened its base two years ago and accepted non-researchers as members, I think that our experience has been a very positive one. I have been an active and very privileged witness to this fact and if the institution is not maintained, as the Chairman has stated, our objective is not to maintain it. We hope that the functions performed by the institution will be maintained. We also hope that your committee will be able to find ways of better fulfilling these functions. Thank you.

**The Chairman:** Thank you very much.

[Text]

**Senator Hicks:** Mr. Chairman, perhaps we could spend just a few moments questioning Professor Brownstone before we move on.

**The Chairman:** We might as well devote a few minutes to that, yes.

**Senator Hicks:** First of all, Professor Brownstone, what is the magnitude of this problem which is stated on page 3 of your report under section 4:

We have changed our own constitution so as to enlist the fees and subscriptions of hundreds of individuals and groups and these revenues help meet the costs of the information network that cannot provide funds for significant research.

What is your budget? What portion of it is raised from fees and what portion of it comes from government? Are you really in the position where, if the ministry does not support you, you will have to fold up your tents and steal away in the night.

**Professor Brownstone:** Perhaps I could ask Mr. Lang to help me on this.

**Senator Hicks:** You do not have to give it in great detail.



**Professor Brownstone:** Our overall budget is roughly \$1 million per year, which virtually all comes from the federal government, for both our administration and our research funds.

**Senator Hicks:** So the fees and subscriptions of hundreds of individuals are not significant.

**Professor Brownstone:** No, they are not.

**Mr. Vernon Lang, Executive Director, Canadian Council of Urban and Regional Research:** Mr. Chairman, the total budget was in the neighbourhood of a quarter of a million dollars, not one millions dollars.

At the present time in the current year, which is all I am competent to speak about because I am new, we have a research program which totals about \$190,000, all of which was committed before the present year began.

I do not think I quite understood the rest of your question. Were you talking about our budget only, or about the size of the research demands?

**Senator Hicks:** I was trying to put figures on the statement contained in the second sentence in paragraph 4 of your brief in order to find out the amount of the fees and subscriptions from the hundreds of individuals, and in order to have some idea how significant that is in relation to your annual activities.

**Mr. Lang:** No, the total support from fees and subscriptions is in the neighbourhood of \$10,000, so it does nothing but contribute towards the postage, as it were, involved in the whole operation.

**Senator Hicks:** It is your view, then, Professor Brownstone, that, if the ministry were to withdraw its substantial support to you, you would have no alternative but to close your operations.

**Professor Brownstone:** Mr. Chairman, we are closing our operations now. The ministry support was withdrawn last year and this is our final year. We cannot continue without the support. We are totally dependent on federal government support for our continued existence.

I should point out, Mr. Chairman, that over the years we have made strenuous, and at times very expensive, efforts to increase our funding base, but we have not succeeded. We have attempted to do this via the provincial governments, the municipal governments and the private sector, but we have not succeeded in raising sufficient funds to maintain an operation. So we have been totally dependent on the federal government, or a combination of the federal government and the Ford Foundation, for our existence over the past 15 years.

**The Chairman:** You don't want to, but you are forced to commit suicide.

**Professor Brownstone:** Yes, but, as we have pointed out already, we do not want to see our activities and functions disappear. They are much too important for the Canadian future to simply let them drift away.

**Senator Hicks:** All right. That brings me, then, to a sentence near the bottom of page 3 in which you say:

If there were a strong federal-provincial system for these purposes in being, it might be said that our council has served its purpose and should withdraw; but there is not.

Is there any prospect of your work being taken up by any combination of activities of the federal and provincial governments?

**Professor Brownstone:** No, I think not, Mr. Chairman. I think the important point which I tried to make earlier was the necessity of an independent body, such as ours, continuing to operate in this area for the reasons cited. It is not my feeling, or the feeling of council, that a government or a combination of governments can fill this essential need.

**Senator Lang:** Are there not counterpart, independent organizations at municipal or provincial levels throughout the country?

**Professor Brownstone:** There are organizations across Canada which may reasonably be described as independent and which carry on some research, but not in terms of a national trans-Canada kind of operation, and with nowhere near the necessary complexity that the Canadian council has operated with. We attempted to mobilize, if I can use extravagant terms, the total research production user community across the country, to develop the scale of competence necessary to tackle the urban problem, which is extremely complex and extremely difficult. Perhaps I might ask other members of the delegation to respond to this kind of question.

**The Chairman:** Before you go on, I must say that I am still not clear on this. Let us deal with the budget and its distribution before Urban Affairs ceased supporting you. What was that budget in 1974-75, and how was it distributed between, let us say, providing a network of information, and research?

**Professor Brownstone:** Perhaps I could ask Mr. Lang or Mr. Cournoyer to answer that.

**Mr. Robert Cournoyer, Canadian Council of Urban and Regional Research, Quebec:** Mr. Chairman, I was director of the council for three years, from 1972 to last year, 1975. There has been a sort of up and down history as to funding. In the 1960s the council's budget increased steadily, but very slowly, from about, I think, \$16,000 a year in 1967, to about \$150,000 at the end of the 1960s. Then there was a very difficult period in about 1970-71, when the ministry of state was under discussion and at the conception stage, and a number of questions were in suspense as to what institutions would remain, and the degree of authority they would get, and so on.

When the ministry of state was created, in 1971, the council was able to argue its role and its functions to the extent that the ministry provided increased funding in 1972, 1973 and up to 1975, so that it moved from about, as I said, \$150,000 in 1970 to about half a million in 1974-75.

As the budget increased, a larger and larger proportion of it was devoted to research, because there is a core function of communication which has to be maintained, whatever the scale on which you are operating. I think it would be interesting for this committee to examine the experience of other institutions in this regard, but my contention is that no national organization performing more than just communication functions among its members can operate with a budget of less than \$100,000 a year in terms of national staff, and having some means of communication such as a bulletin or journal, or meetings, and all the necessary things that you need to keep a group

together and to allow its members to meet and exchange views in order to do what they have to do.

**The Chairman:** But to concentrate on 1974-75, when the budget reached half a million dollars, how much was devoted to research?

**Mr. Cournoyer:** About two-thirds.

**The Chairman:** And the rest?

**Mr. Cournoyer:** The rest was for this communication function I was talking about, but some of that was devoted to a more specialized communication function, which is the *Urban & Regional References*. So I would say that half of that was for the specialized communication function, and the other half was for the general maintenance of communications.

**Senator Hicks:** And that would include both *References* and *Urban Forum*.

**Mr. Cournoyer:** Right.

**Senator Hicks:** And of this half million dollars, in the year to which you have referred, about \$10,000 may have come from fees and subscriptions, and the rest from the department.

**Mr. Cournoyer:** It was beginning to, because this was the year in which we changed our constitution, so it did not reach that level until late in the year.

**Senator Hicks:** Just to be perfectly sure that I understood you, you say that you think the minimum basic budget needed by an organization like yours, or any similar organization that proposes to function nationally, and to communicate across the nation, is \$100,000. I believe that was the figure you quoted.

**Mr. Cournoyer:** That is, as I said, if you want to have functions other than simply communicating among your members. If the organization is simply a network of people with a particular interest, you can maintain a secretariat with an executive director, or with a director or secretary of some sort or, as I say, a sort of light communication medium such as a news bulletin or something, but even that, as you can quickly add up, will amount to at least \$50,000 or \$60,000. That will be the rock-bottom cost. If you want to have any specialized function of the kind the council was performing, you need much more. The council, you see, was a granting agency and not simply a network of interested people. It was a granting agency as well as a specialized communicator of information. If you want to have this function, at least, \$100,000 does not even begin to do the job at 1976 prices.

**Senator Hicks:** It was a granting agency in the sense that it provided funds for certain specific research projects to individuals or groups that were willing to undertake them.

**Mr. Cournoyer:** Yes. In fact it is much more now, because it simply did not wait for proposals to come in. There was a great deal of stimulation, initiation and negotiation work being carried on. In other words, the staff time per unit of research supported, I think, was considerably higher than it would be in an agency such as the one that Senator Hicks would know well, the Canada Council, or certain other organizations.

**The Chairman:** And in 1974-75 you did not receive anything from Central Mortgage and Housing.

**Mr. Cournoyer:** No. The granting function was completely turned over to the Minister of State for Urban Affairs in 1972-73 for the first time.

**The Chairman:** This grant has been stopped now. Does that mean that there will be continued support for extramural research and development in urban affairs from the ministry, or is the ministry proposing to do it in-house, or is it not proposing to do it at all?

**Mr. Cournoyer:** I would not presume to speak for the Ministry. I think the situation at the ministry now, from the various contacts that I have on a very regular basis as a sort of opposite number in the provincial government, is very confused, and I would not presume to speculate on it. I personally would suppose that they will continue to contract for this kind of research.

**The Chairman:** But are they doing it?

**Mr. Cournoyer:** They are doing it now. A lot of this is continued commitments to things that have been undertaken even three years ago, and there is still some in-house research being done.

**Senator Hicks:** Assuming the research you previously supported is being directly supported by the department now.

**Mr. Cournoyer:** Some of it, yes.

**Senator Hicks:** Or similar research.

**Mr. Cournoyer:** Yes.

**Professor Brownstone:** I would like to point out that that kind of funding is no substitute for the functioning of an independent body like the Canada Council.

**Senator Hicks:** I think we are all familiar with the arguments you would put forward for that. Many would agree with them.

**Senator Godfrey:** Some would disagree. I would like to know the difference between your council's retaining a university professor to do a certain type of research and that professor's being retained directly by the department.

**Professor Brownstone:** I think you used the word "retained" somewhat differently.

**Senator Godfrey:** Contracted out.

**Professor Brownstone:** There are some major differences. First, if we request a piece of research, it is based on a discussion within the council. It is an open membership council which operates, I hope, as a very democratic institution in which we have many diverse opinions, many diverse perspectives, which are considered in the process of developing a council-sponsored type of research. The foundations of that research are quite different from a ministry or department of government. That is a first and major difference between the two forums.

At the output end of the research process, our council is committed, and has been committed from its initiation, to openness in communication and publication. This is again a striking difference. I would venture to say, Mr. Chairman—and perhaps I could be somewhat corrected—that very little, if any, of the internal and external research of the Ministry of State for Urban Affairs ever reaches the publication stage. I have seen very little of it. This is a striking difference and a striking reason for a body such as



ourselves. I can cite you one example we were discussing this last night. One of our directors pointed out that with a \$150,000 grant in research we produce 120 publications. The Ministry of State with perhaps a large multiple of that have produced literally zero.

**Senator Hicks:** The answer to Senator Godfrey's question is very well developed in Professor Rowat's paper, "The Decline of Research in the Social Sciences". He gives all the academic answers to the questions you have made.

**The Chairman:** What would be the estimate of research on urban problems?

**Professor Brownstone:** Globally?

**The Chairman:** Globally.

**Senator Hicks:** In Canada.

**The Chairman:** Of course, in Canada.

**Senator Hicks:** We are not the whole of the globe.

**The Chairman:** In our global village.

**Professor Brownstone:** We have some rough data, Mr. Chairman, published by Statistics Canada which, if put together with a few estimates of our own, adds up to about \$15 million. This is far short of our own advice to this Senate committee in 1969 that the level then should have been \$25 million.

**The Chairman:** That was mentioned.

**Professor Brownstone:** That is far below what it should be today.

**The Chairman:** That includes intramural research which you say is not available to the public. What would be the extramural portion?

**Professor Brownstone:** I think the split is fifty-fifty.

**Mr. Lang:** Roughly, we estimated \$5 million extramural. From Statistics Canada we estimated a generous ratio was two-thirds extramural, so you have \$7.5 million. We took a wild guess that there might be an equal amount being sponsored by other bodies than the federal government in other parts of the country. That is how we reached the amount of \$15 million.

**Professor Brownstone:** It might help if I ask both Dr. Hitchcock and Mr. King, who have some experience in extramural research and its availability.

**Professor John Hitchcock, Canadian Council of Urban and Regional Research:** Mr. Chairman, I would characterize the difficulties from the university's point of view as discontinuity and invisibility. There are changes in fractions in urban research and urban studies. Urban research is not a natural university grouping. It requires people of cross-disciplines, so it needs consistent encouragement. The history, to my knowledge, in recent years has been one of large amounts of funds being spent in one year and not another year. There is no consistency.

In terms of the university community there is a lack of knowledge about what research is, in fact, going on, as well as the published results of that research. My comment would not lead so much to the volume of funds, as the need for consistent, steady encouragement of a particular area of research, and for the encouragement of new researchers

and new ideas. The extramural research in the federal government tends to use known researchers. After a time that reservoir of ideas gets used up. Without some mechanism for maintaining resource space for new people and new ideas there are continuous difficulties for the future.

**Senator Hicks:** If I could try to conclude my questioning, Mr. Chairman, I would go directly to the recommendations to the Senate committee commencing on page 4, paragraph 6. I think it is not inappropriate to ask Professor Brownstone to comment on these recommendations in view of the discussion we have had here. As I understand them, the first one, while it does not say that you should be kept alive, it says that those in authority should build immediately upon the existing experience in networks. I presume the ministry would say they are doing that.

**The Chairman:** I am sorry, senator. There is this statement on page 3:

In our view the Ministry of State has abdicated in regard to one of the declared purposes for which it was created.

**Senator Hicks:** The second recommendation, notwithstanding the fact that you are disbanding, asks that you be kept alive until some other organization is developed to replace you. The third one says that the scientific and technological information system be kept in being, mentioning specifically your two publications.

**Professor Brownstone:** That is correct.

**Senator Hicks:** Perhaps you should comment on this, in view of the discussion we have just had.

**Professor Brownstone:** Dealing with the third point first, I did report very briefly in my opening statement that some progress had been made.

**Senator Hicks:** You did not tell us what it was. Perhaps you could elaborate on this, if it is proper to do so.

**Professor Brownstone:** Perhaps Mr. Lang could speak on this.

**Mr. Lang:** In addition to liquidating the council, my responsibility this year was to find new homes for its most valuable projects. In the case of *Urban Forum*, the quarterly journal, we have as yet no solution beyond the publication of our last issue. It happens that this very day we are having a meeting of representatives of some planning schools, some governments, who might or might not be interested in forming a consortium to publish this. They might or might not be able to put up the funds. They may put up some, and seek support from the Secretary of State or the Canada Council, to permit the publication of this specialized journal.

In reference to the *Urban & Regional References*, the bibliography, we are in the process of bringing out our final edition. I have been negotiating with an organization known as Micromedia Limited who put out all kinds of documents in a micro-fiche form. They have undertaken to publish a quarterly edition, having in mind that in two or three years the distribution of this would result in enough sales of their underlying production documents in micro-fiche form to recoup their investment. The initial investment is very large. They have been negotiating with the ministry, with some assistance from some of us, for an initial grant of roughly \$20,000 to help them set up all of the program that is involved. I have not at this stage seen

the contract with the ministry which would provide these funds, so I cannot say whether they have committed them or not. But all of the conversations I have heard indicate that they are assuming that it will go through. So reference to the bibliography would reappear in a new form which would be more frequent, but less detailed.

We have reason to believe that will occur. Whether that is the right solution, I do not know, but it is the best one we could arrange under the circumstances of operating out of our savings rather than out of the grant.

**Professor Brownstone:** Our second recommendation, Mr. Chairman and Senator Hicks, is:

That your Committee urge at once (by interim report if appropriate) that the one institution of accomplishment in this field be maintained by the Ministry until it is certain that its level of attention and activity on these issues can be maintained by other means.

This was certainly our argument to the ministry in our last submission.

**The Chairman:** When you say "in this field", do you mean again your publications and information system or research?

**Professor Brownstone:** No, we mean the total activities of the institution, because I regard the research function really as being the paramount function, the key function. This is really the development and dissemination of knowledge available to the application of research, but without the application of relevant knowledge and relevant research we are nowhere. This recommendation is designed to focus on that particular aspect of the Council's work.

I do not think this question can be answered fully without a brief review of the ministry of state itself, and its functions and faith in the policy system within Canada. As we all know, the ministry of state is a curious creature in the tradition of government in Canada and, I think, an interesting one. It was designed primarily to develop an effective urban focus in the federal government, to permit the political and administrative machinery of the federal government to focus quite clearly and explicitly on the urban situation and urban policy. In order to do that, we needed a mechanism which could affect or influence decisions in policy-making across the whole range of government functions and government departments. This ministry was based on two principles. One was the development of power influence or decision-making through knowledge, access to knowledge; and the second, a function which we can term, roughly, co-ordination.

The ministry was not given authoritative power in the same sense as it is given to other departments. It was not given an operational budget and it was not given a program to accomplish. It was given the mandate to develop a co-ordinated federal approach to urban policy.

One of its chief thrusts in this area was, of course, to develop expert, competent knowledge within itself, which it would then use to somehow co-ordinate and discipline federal policies as a whole, with a particular focus on urban policy. I need not go into detailed explanations of how the system works; I just wish to focus on the attempts of the ministry to play its role through the development and use of knowledge. I believe that those of us who have been watching it for some years have watched an understandable struggle for identity and form in that ministry.

It began, I would think and is typified as such, as a research institute, very broadly based, attempting to do research in every aspect of the urban situation through what I would typify as a perhaps somewhat exaggerated university form of research institute. To do this, it literally invaded the entire urban research community in Canada. I do not wish to describe it in any sinister way, but to many of us on the outside it appeared as an octopus with tentacles in every research institute in the country attempting to absorb into itself urban knowledge and to use this knowledge, presumably, in an effective sense within the federal government to influence urban policy.

In so doing it affected of course, the behaviour and the form of many of the existing research institutions, universities, independent bodies and so on. In this context, our own council was still initially associated with CMHC. It had a tradition of research in this area and continued to exist but under, I think, this kind of general outlook of the Ministry of State for Urban Affairs. I think more latterly the ministry discovered that it not only had to accumulate knowledge to use in advising the federal government, but also it had to accumulate and use more relevant knowledge.

Here we began to get in the ministry a focused approach to urban policy in terms of very selected, although broad, policy areas to which research was to be tied, and we began to get a more directed form of approach to research. Concurrently with this the ministry had to decide whether it was going to continue to emphasize in-house or external research, which type of research thrust was more effective in permitting it to play its role as the major policy body with respect to the urban situation in Canada.

So the second sort of phase of the ministry was to emphasize, first of all, directed research within policy areas and, secondly, I think, to begin to attempt to encapsulate that research more and more within the policy imperatives of the federal government.

It is in this context that the Canadian Council of Urban and Regional Research met its fate. It was, I think, the deliberate decision of the ministry to encapsulate the process of urban research and policy-making even more so than in the past which led to the cutting out of the support for the council. This was done, Mr. Chairman, before the current round of federal cut-backs was instituted. So the decision of the ministry was based on reasons other than the...

**Senator Hicks:** The cut-backs?

**Professor Brownstone:** Yes, the cut-backs.

**Senator Hicks:** Although they had advance knowledge of that? However, what I really want to find out is whether in recommendations 1 and 2 you are asking us to do what you have already attempted with the ministry and failed?

**Professor Brownstone:** That is correct. We are once more approaching the state in the form of the Senate, and we are making the same plea more urgently because we do not believe the situation has improved since we approached the ministry of state. I stress again, Mr. Chairman, that this is basically for the activities, although my candid opinion is that we are also asking for institutional support.

**The Chairman:** I believe we have got the point very clearly this morning. I would have had a few further questions to ask, but I will refrain.



**Senator Carter:** I do not require any detail, Mr. Chairman, but I would like to know something of the nature of the research that the council has already done, bearing in mind that we are living in a very different world now from what it was when you were before us the last time in 1969. We are being forced into a conserver society. What effect is that having on the type of research that needs to be carried out? Would you specify the type of projects you are doing, or have done, otherwise we do not really know what your recommendations are worth.

**Professor Hans Blumenfeld, Canadian Council of Urban and Regional Research:** I have not been in very close contact during the last year, but in quite a number of previous years I worked with the committee only. However, there is a very widespread feeling as to what could happen with respect to the various projects. We also developed a program, which has not fully come to fruition because of lack of funds, on a number of major themes. I was particularly concerned with the theme "A trend to the metropolis." But it struck me generally, in comparing the work which was done under the auspices of the council and other regional research with other research, both in-house and otherwise, of the ministries and the Science Council of Canada, that the cost effectiveness of the work carried out under the auspices of the Council, which apparently now is forced to fold, has been considerably greater than any other I have been in contact with. I consider it a tragedy, really, that this council is forced to go out of existence. It got off the ground in the first place only through the generosity of the Ford Foundation, and, unfortunately, up to date it has not found any other Canadian sources, either governmental or private, to support the very important function it performs.

**Professor Brownstone:** Mr. Chairman, if I might, I could just run through a few samples of the responses, if that would help.

**Senator Carter:** Yes, just the names of them.

**Senator Yuzyk:** Or at least the larger projects.

**Professor Brownstone:** Yes. Well here is one on urban transportation systems for the city of Regina, and some consultants setting transit systems for that particular city. That was presented to the Canadian Good Roads Association as having a major impact on urban transportation systems. There was another grant to Eric Hanson of the University of Alberta on public financial practices affecting urban patterns. There is another study on urban change, redevelopment and conservation by Peter Pineo of Carleton and McMaster Universities, Murray Jones of Toronto and Michel Barcelo of the University of Montreal under that same heading. Leslie King of McGill and McMaster Universities did a study on the human effects of urbanism. We did a series of studies on the growth of metropolitan centers. We did a study on public private interaction on major urban projects which was later published as a study by Professor Collier. We worked with the Canadian Federation of Mayors and Municipalities on education for urban management. We did some research in that particular area, and made some research grants for those particular projects. We have done work on regional development. We gave a \$15,000 grant to Arthur Stinson and Alan Clarke of Algonquin College to work on community awareness and action in the Ottawa valley. These just give you a rough idea of what we have been doing.

**Senator Carter:** That answers my question. The second part is that now that we are moving towards a conserver society, what effect will that have on the type of research needed?

**The Chairman:** It strikes me, as it struck me when we went through our first inquiry, that we are spending billions and billions of dollars every year to destroy our environment, through CMHC and so on, and devoting very little research in urban affairs to try to prevent this crisis.

**Mr. Cournoyer:** In specific answer to that question, I might say that towards the end of 1974, while we were still assured of some funding and were, in fact, trying to expand our activities, while at the same time focusing or trying to focus some of our attention on the emerging issues such as you have just mentioned, our strategy was to keep a certain amount of the budget open for innovative research proposals which might arrive any morning; they are pretty hard to predict. At the same time, we were to take a third of our budget, or something of that order, and focus it on certain emerging issues. We had one group of people, a sort of informal research task force, that was beginning to meet, and did meet two or three times, in the winter of 1974-75, to develop a research project exactly on this theme. In fact, I know that, with respect to the regional forums, during this current year part of the remaining council funds, as the chairman has indicated, will be spent on supporting regional forums, each on specific themes. I know the British Columbia group is organizing a series of investigations and will hold, I presume, some sort of seminar on this question in the fall.

I do not know the details of what is happening in other regions. That is one of the problems of the council's not being able to operate as it did. We do not meet any more so we do not know as much about what is happening in the other parts of the country as we should. In my new position, I find that it is a real handicap not being able to communicate with other people, other officials with responsibilities similar to mine, to know what the leading edge of research is. Because when you read about research projects in publications, it is about two or three years too late. If the fellow had the idea three, four or five years before, and then submitted his application to some granting agency, which, took a year to process it, then by now he has done it and published it and is on to something else. So you need a communication network to know about this kind of research.

Another thing I wish to mention is that we in the Quebec group of the council have focused on the problem of land and land management, and land as the rare resource. We had a very successful seminar last May in which this question was examined from several points of view. We examined it from the point of view of recycling urban land, recycling neighbourhoods, and so on, as well as managing fringe land in this context.

**The Chairman:** Professor Brownstone, have you met the minister with your problem?

**Professor Brownstone:** Currently, recently? No, we have not. We have not met with him since our discussions with him last year.

**Senator Carter:** Professor Brownstone referred to some gaps in our knowledge. I wonder if he could specify those?

**The Chairman:** I am sure we have many gaps.

**Professor Brownstone:** Senator Carter, you raised one of them when you mentioned the whole question of the conservator society. That has only arisen in the past five years or so. That is a major issue in Canada.

**Senator Yuzyk:** Mr. Chairman, the liquidation of a council of this type might well have tragic consequences. Perhaps it will not, but one of our functions is to look into this matter, since we do not know at this stage what the ministry has in mind, but we do have a good idea now of the projects and the work which the council has been doing. We will not be satisfied if the work is not carried on in some shape or form. Therefore, I would suggest that our committee get a statement from the ministry, or perhaps get the officials of the ministry before the committee, so that we can have some idea of the plans of the ministry in this field before we make our decision.

**The Chairman:** Senator Yuzyk, I will certainly put that suggestion to the committee when we sit *in camera* to determine our schedule for the coming months.

Thank you very much for your presentation, Professor Brownstone. You may be assured that we will give it very serious consideration.

**Professor Brownstone:** Thank you, Mr. Chairman.

**The Chairman:** We will now hear from Dr. J. J. Loubser, the Director of the Social Science Research Council of Canada.

**Dr. J. J. Loubser, Director, Social Science Research Council of Canada:** Mr. Chairman and honourable senators, I should like to thank the committee very much for the privilege of appearing this morning. I should also like to ask you to bear with me, because I must offer the apologies of the elected officers of the council who were unable to be with us this morning. They have asked me to convey their regrets to you, but they are all committed to teaching activities in the university year which has just begun, and they have found it impossible to relieve themselves of their duties in order to be with us here this morning.

I hope that you will share the degree of confidence that they have shown in me in having me act here as spokesman of the council. I might add that we do have with us people who are very familiar with the Council and who could also act as delegates from the Social Science Research Council. I refer particularly to Professor Hugh Thorburn, from Political Studies at Queen's, who is a former president of the Social Sciences Research Council, and Professor Conrad Winn, who is the current secretary-treasurer of the Canadian Political Science Association. Of course, they appear primarily on behalf of the CPSA. I would like to make it clear that as a council we do not pretend to speak for all our member associations. While they may speak for the council, I am sure they will feel free to differ quite radically from me, if they so desire.

**The Chairman:** Autonomy seems to be a recurrent theme here.

**Senator Hicks:** Not only as between one discipline and another, but among divisions of the same discipline. Is Dr. Joly with you?

**Dr. Loubser:** Dr. Joly called this morning to tell me that he is house-bound with a flu infection, and asked me to give his apologies.

I should also like to point out that we have with us Mr. Robert Cournoyer, who assisted the council greatly in the planning of the National Social Science Conference last year, and Professor Leslie King, who has already been introduced, but who is also a member of our Research Policy Committee.

Finally I would like to introduce Mr. Armstrong, of the Canada Council. Since we relate very directly to the Canada Council, I am very pleased to see that he is here. Perhaps he will be willing to correct some of the misrepresentations that I may, quite unintentionally, make with regard to the Canada Council.

**The Chairman:** I may say that we have not yet heard from the Canada Council, but I am certainly going to suggest to the committee that they should be on our list for the hearings of the committee in November.

**Dr. Loubser:** Perhaps I might start out, Mr. Chairman, by saying that I am very pleased that we began this morning the way we did, with a presentation from the Canadian Council of Urban and Regional Research.

I might just tell you, parenthetically, that the SSRCC is a non-governmental federation of learned societies with a very small budget. Mr. Boucher repeated a phrase that is so often used, which tends to confuse the Social Science Research Council of Canada with the granting function for the social sciences of the Canada Council. We have a very small budget; we are non-governmental; we do not support research; and we focus entirely on the development of infrastructures, the support of communications and the development of policies affecting research and the social sciences. We have a research policy committee for that purpose, of which Professor Leslie King is a member. Linking this to the earlier presentation, I might just say that the research policy committee recently asked Professor King to produce a study of the funding of urban research in Canada as a case study of the kinds of policy problems that we face in social science research. I would be very glad to submit a copy of that paper to the Senate committee in addition to the presentations of CCURR, because it very much supports, I believe, the position that you heard this morning.

The second reason that I am glad you had this, as you said, more limited, more focused presentation, is that it really presents you with a very graphic picture of the general sort of thing that I am going to talk about, and that has been put forward in the presentations that we have made to you about the lack of adequate support for social science research and for infrastructures to encourage, maintain and accumulate that research.

I think it is fair to say, probably, that among areas of social science research, urban research is probably one of those that are better supported than many others. In a sense, up to now, both in terms of dollars and in terms of the role of this council and various institutions and universities around the country, it has had both the resource base and the infrastructure that enabled us perhaps to do better and more relevant work in that area than in many areas in the social sciences. I think it is from this point of view that the disappearance of CCURR, and the apparent inability to set up an institution with a similar national role in this area is so tragic, and so harmful to social science research in this area, and really brings it down to the level at which most other areas of the social sciences still remain in this country.



I certainly would hope that the Senate committee, in trying to do something about the retention of this particular infrastructure in some form, playing the kind of role that it has played in the past, will pay attention to the fact that this is only one case of a very general problem in social science research. We do not have those kinds of infrastructures to encourage, accumulate and focus research work in this country on very major problem areas like urban problems, population problems, multi-culturalism, bilingualism, and the rest.

Mr. Chairman, with that pick-up from the specifics of the previous presentation, I do not think that I really need to reiterate in detail the case that we tried to put before you in the brief. As a matter of fact, we felt we were very much "carrying coals to Newcastle", if you will permit a metaphor from a previous energy phase of civilization.

**Senator Hicks:** We may be coming back to it.

**Dr. Loubser:** Yes. Perhaps it is, on the contrary, futuristic.

However, the first point that we wish to make we perhaps made more explicitly in the statement that the council produced in June, and that is to try to provide a rationale for why social science research is important to Canada. We were partly forced into this because we seemed to assume that it is a "motherhood" question, and that everybody knows that it is important. However, we ran into people in the ministry, in particular, who said, "Why should Canada support social science research? Why cannot it buy from the United States, or use data that is being produced elsewhere?"

**The Chairman:** When you say, "the ministry", which one do you mean?

**Dr. Loubser:** Science and Technology. They said, "Do not tell us you are worse off than you were in 1969. Maybe you were too well off in 1969. Give us a qualitative argument for why your research is important."

I think our statement has tried, in a very initial way, to articulate the arguments showing why, in particular, social science research is something that we cannot import from anywhere else, or if we do, we do so at our peril.

**Senator Godfrey:** It might be helpful if you would just say what you mean by "social sciences", and how they are distinguished from the humanities at the moment, and what is covered by the humanities. I am thinking of the record.

**Dr. Loubser:** Yes. Well, you are asking me to talk about something we hate to talk about, because it is so difficult to distinguish them. We have very cordial relations with our colleagues from the humanities, Dr. Steedman and Dr. Savard. I think the boundary is less defined than it is between Canada and the United States, but we retain similar kinds of relations in many ways.

Some of the disciplines—for example, history—are in both camps. Mr. Savard is a historian, with a very strong social orientation. He is the past chairman of the Humanities Research Council. For SSRCC, our second past-president is the historian, Syd. Wise, from Carleton University. So you can see that history has always been in both camps. But for SSRCC, history is a social science and the other social sciences are the traditional disciplines of sociology, economics, political science, psychology, geography, law, education, anthropology, and the administrative sciences.

We have at the moment ten disciplines represented officially in the council.

We do not have in our structure at the moment any inter-disciplinary areas, like urban research, for example. We have decided to change the constitution to accommodate associations like CCURR, and others, so that they can become members of the Council, and make it more able to focus on those areas.

I talk about the relevance and importance of social science research in Canada. Much of it is because knowledge about urban conditions in Canada cannot be imported from the knowledge of urban conditions in other countries. You must take the other step of testing that hypothetical knowledge about what might be the situation through actual research of the situation in Canada. It is not enough, as in the physical sciences and technological application, to know just the rough structure. It is at a higher level. You have to have specific knowledge of the community problems in Toronto, and at your peril you transfer them to Montreal. You have to have specific knowledge of Canadian conditions in order to be able to develop relevant and appropriate effective policies. That is the general argument which I would like to speak to at greater length, if you are interested. I will not detain you longer because I know that time is short.

The main concern we wish to put before you is the case for a shift in priorities towards greater support for social sciences and humanities research in this country. The Senate committee has so eloquently presented it in 1972. It has simply not taken place. As a matter of fact, in urban research we are much worse off today than we were five years ago, partly because the funding pattern has not shifted, partly because of the well-documented expansion of manpower in the universities in the social sciences in the last five to ten years. As Senator Hicks has pointed out, Professor Rowat has presented the traditional arguments of the importance of independent research and its currently impoverished state. I hope those arguments are not simply the shibboleths of the academics, but that the politicians can also see the importance of having that kind of resource well developed in a society with the kind of problems which Canada has.

We wish to recommend to you that this situation needs immediate attention. We need increased support for social science research at a level that has simply not existed before in this country. I might say the negotiated grants program that the Canada Council introduced two years ago—and it is now in its second granting year—is the first time that we really have had a program to support social science research at a level which is commensurate with the sort of criteria established on the study that Karl Deutsch and others have done of the institutional conditions, size and level of support in social science research that is likely to contribute to major social innovations, and to development of new and significant knowledge. I think the only existing program of support for social science research that makes this for the first time feasible in Canada is the negotiated grant program from the Canada Council. The program has been maintained under present cutback and freeze conditions only at the expense of other equally important programs of support for social science research.

The other concern that relates very much to this, and which makes us more concerned, is that if you look at the total dollars being spent on human science activities by the federal government, there is a slight increase of extramur-

ral research over in-house research. It is a very slight one. Although the universities and Canada Council have been getting less of that extramural dollar than they have in the past, there is a greater emphasis on extramural research to non-profit foundations and other performers. But the fact is that the federal government is still spending more than twice as much on intramural social science and human science research than it does on independent research through the Canada Council.

**The Chairman:** Compared with the university, not with total extramural.

**Dr. Loubser:** Yes.

**The Chairman:** We will come back to this.

**Dr. Loubser:** We feel, in terms of allocation of money to research in the human sciences, that we have exactly the same reservations about the in-house research that is going on which have already been articulated to you. The arguments are very much the same. The quality is unknown, the relevance is unknown. It does not contribute to the public pool of knowledge about Canadian society in the way that independent, published research does. Unless the policies governing that type of research can be dramatically changed, we feel in terms of the relative priorities within the human sciences field that there is a misallocation of resources that we would like to see reversed. That is our second recommendation, complementary to the first.

In the same area we have a concern that I think this committee shared in its report, that was partly projected or expressed in your intention of bringing out a fourth volume eventually on the social sciences and social innovation. I do not know exactly how you faced it. This special committee, although it treated the social sciences as part of the total science policy throughout its report, did not really focus to the same extent on the special problems pertaining to social science, as I think are very concretely and graphically reflected in the fate of CCURR and support policies in general. The result is, I think, that we have no statement on social science policy in Canada at the moment of the same level of detail and comprehension as we have of general science policy.

As you know, the OECD, in part of its review of social science policy in other countries, has commissioned a study of social science policy in Canada. I do not know if you have better information, but I believe that the report is indefinitely postponed because it is so controversial in some of its aspects that there could not be agreement to publish it. When we have pushed for the development of long-term support policies for social science research in this country, we have always been told to wait for the OECD study, or wait for the Senate committee's fourth volume, or we need to study the situation more. I must say that I do not see on the horizon at the moment anyone who is willing to sponsor and support the development of that long range support for social science research. I am not talking about just basic research; I am talking about applied policy-oriented research pretty much with the kind of mix that was quite admirably achieved in CCURR.

The Social Science Research Council believes that it has the kind of independence, the kind of representative structure of the scholarly community, and the mechanisms to perform this kind of study and to advise government on social science policy as a long-term development policy for research. But it will have to be recognized as such, pretty much as this committee has recommended that the Royal

Society be recognized—which brings me to that recommendation.

**The Chairman:** I do not think you should spend too much time on this. It is in your brief.

**Dr. Loubser:** It is in our brief, but I am disturbed by two facts. One is that the Royal Society has been given a grant or contract to develop a proposal for what kind of research it can do for various governments. I do not know whether you have seen that document, but I think it is a disgrace to the scientific community of Canada, particularly the social science community. If you ever need graphic evidence that the Royal Society is incapable of performing that kind of task, you have it in that document.

Secondly, I think in its appearance before this committee, the Royal Society has reported on progress it has made in developing the role as representative of the scientific community in international affairs. Again, as the Social Science Research Council, and certainly with our colleagues in the Humanities Research Council, we cannot and will not accept that kind of role for the Royal Society.

I might just say for the information of the committee, Mr. Chairman, that we developed a joint proposal for the support of international representational activities for the social science and humanities communities and submitted it to the Canada Council. The Canada Council accepted that proposal in principle, extended it to the arts and put the program under the administration of the secretariat of the Canadian Commission for UNESCO. We were very unhappy and remain unhappy about this decision. We believe that the two research councils are well structured and well equipped with much experience in this area. When government policy in this area is cleared up we would like to see the two research councils given responsibility for representational activities internationally, rather than the Royal Society or some other body, such as the UNESCO Commission.

I have two final points, Mr. Chairman, if you will permit me. I would like to emphasize this with relation to the concern that this committee has had in its report on the future study of policy with an independent institute or academy, as you have termed it, that could carry out ongoing research with respect to problems in the social sciences. I believe you have called it the Institute for Social Research. Now, it appears at the moment that, at least at the level of decision, it has been decided that the Institute for Research in Public Policy will take up this role, as you reported to the Senate last year. We still have not seen exactly what this role will be, but we have several concerns with respect to it. The first concern is that we do not think that future studies can be done in a meaningful way without the accumulation, co-ordination and codification, in a sense, of a systematic body of knowledge about Canadian societies in their various aspects.

I believe that Mr. Nixon's letter to Dr. Carrothers was somewhat aware of that, but the focus was on being able to choose alternatives for the future. We would like to emphasize the fact that we do not have at the national institutional level at the moment the equipment of the Science Council or the Economic Council, which can produce an annual review of the state of the society, so to speak, in all its various complex aspects, and identify the trends, project them into the future and, possibly, do the work of searching for alternatives. I believe the feeling we have in that regard is that in this type of function, the system certainly, the technology, the software and hard-



ware for doing the job of accumulating and co-ordinating knowledge and projecting it into the future, is the same machinery that is needed I think that the latter future study can only be carried out on the basis of adequate, comprehensive knowledge of the current trends.

We feel that the Senate committee might well keep a watching brief, as it has been authorized to do, not only on government research in this area, but perhaps to promote this idea of not only the Economic Council or the Science Council, but of an Institute for Social Research. The Science Council, with their concerns of the conservator society, the population and urban problems—it is all over the field in social science areas—has very few, if any, competent social scientists on its staff or membership. We face an institutional hiatus here that we must fill, and we hope that this committee will initiate this, and will initiate consultations with social scientists who have experience in this area. Certainly, if the SSRCC can be of any assistance in these consultations, which I believe are very much involved in your conference plan, although I did not see the details of that, we would be glad to provide that assistance.

The final point that we would like to make is with respect to the establishment of the new granting Council for the Social Sciences and the Humanities. We see very little hope at the moment, in the present situation, of sorting out the problems that we have been able to identify in social science policy in Canada, the priorities within the social sciences, various types of programs et cetera, without the establishment of that new council—it has been in the air now for more than 10 years—and the provision of adequate resources for it to develop the kind of programs of support which we believe are necessary to reverse the current impoverishment of the social sciences and the under-utilization of just about 90 per cent of the manpower we have in our universities at the moment.

Thank you, Mr. Chairman. If other members of our group would like to speak . . .

**The Chairman:** If you are to allow us a few minutes for questioning, the opening statements will have to be a little shorter. While I note that your statement is very important—and I certainly do not wish to intervene at this stage—I also notice that some of the points you have raised are contained in the brief and I am sure we would like to ask questions on them.

**Dr. David Steedman, Academic Director, Humanities Research Council of Canada:** I am Dr. David Steedman. I represent the Humanities Research Council of Canada, and I have with me Mr. Pierre Savard, Past Chairman of the Council, and Professor of History at the University of Ottawa. At the back of the room is Mr. John Banks, Executive Secretary of both Councils. Actually, we share a joint secretariat with the SSRCC and, like them, we are essentially a non-governmental federation of learned societies in the humanities. Humanities is defined as including languages, literature, philosophy, history to a certain extent, linguistics, music and also religion.

I would simply like to pick up four points of which I have become more aware in the work I have done, having been in this job only a couple of months. I am, therefore, new to the Ottawa bureaucracy. My first point is the whole question of science policy in the government and how the humanities community can relate to it. It is not clear to us, for example, whether the Minister of State for Science and

Technology really has any jurisdiction over, or interest in, the area of the humanities.

**The Chairman:** He certainly has jurisdiction; I do not know whether he has an interest.

**Dr. Steedman:** Secondly, the Science Council has informed us that their new task force on research, which they are setting up at the moment, would be very glad to hear from us, but has said that really they cannot, within their terms of reference, speak about the humanities, although they will speak about the social sciences. Given that most of the statistics concerning the humanities and the social sciences are grouped together, and most of the problems of manpower and everything else are very similar . . .

**The Chairman:** They used to say that they could not speak for the social sciences, either.

**Dr. Steedman:** That is right; so this is our second concern, which we would certainly like clarified. I, indeed, have written to the chairman of the Science Council to request that he include the humanities in his new study, even though it is not theoretically within his jurisdiction.

**The Chairman:** It is in his jurisdiction.

**Dr. Steedman:** I have read the act carefully and I cannot see the word "humanities" or "lettres" mentioned in it, in either French or English.

I should also like to point out that the present general government policy on funding for all science—which has been, I might add, unannounced and undiscussed—consists essentially of letting in-house research grow, encouraging industrial research and letting NRC and the Canada Council be eroded by inflation. This policy is particularly hard on the humanities, since virtually all our research is done in the universities, and very little, except for a bit in the museums, is done intramurally. So this policy of cutting the grants to the granting councils, and thereby cutting the grants to the professors and cutting the research infrastructure, is particularly difficult for us, because it really means that this is the only place we have to turn, and we are essentially a group of individuals working in our studies. We are not involved to a great extent in team research, with the exception of a few publishing projects.

Moreover, I would also like to point out that most of the indirect and overhead costs of humanities research are picked up by the universities and thereby by the provincial governments, and by the federal government through the Fiscal Arrangements Act, and that in a sense cutting the Canada Council and cutting the money that comes from the federal scene to us is cutting just that particular element which allows free time to the individual professor, who, in the humanities, teaches, I might remind you, and is tied down, usually, by nine hours or even 12 hours of teaching per week in certain cases. This research money allows him free time and release time for sabbaticals and free time in the summers, travel money, et cetera, to go to his library or to the archives. Cutting those funds really means that you are cutting humanities research, because we are dependent upon that alone. With the cutback in the universities all over the country, and with the "crunch" on university funding, the extra bits, like small research grants, small travel grants and so on, are very vulnerable as more and more universities concentrate all of their funds on one thing, which is simply paying the professors' salaries, which amount to 80 per cent of most universities'

budgets. So the first thing you cut in a university department is not the professor; it is everything else, and that means that the small amount of money that goes to humanities research is cut.

I would like to emphasize in our situation, although we do not use a great percentage of the total federal research funds—probably less than 10 per cent—and our demands are far from exorbitant, that nevertheless the relatively small amount of money we do have is absolutely crucial.

We would also add that the Canadianization debate which is being fueled by the Symons report and other documents, which will become much greater in the next year or two, is almost irrelevant in the present freeze situation. There is no way that we can recycle our people to pay greater attention to Canadian studies in the present freeze.

Finally, I should like to say that, as Dr. Loubser has pointed out, the Canada Council is locked into programs of major research projects which, in the social sciences are team research projects, and in the humanities are largely sums of money, amounting to several millions of dollars over five years or more, for publishing projects of certain large editions of things like the Dictionary of Canadian Biography. The council is, of course, also committed to give a certain amount of money to its grantees and for student support. This has meant that where the council has had to cut is in what one might call the communications infrastructure for research support. This is crucial for the humanities, and I would point out that the main areas which have been cut, and which have now reached the point where they cannot be cut any further or they will have to close up shop, are those supporting learned societies; that is, the support for their executives to meet, travel and communicate with each other, the support for journals—journal support as opposed to publishing support, has been cut drastically—and this whole area, if you like, of putting the individual scholar, working in isolation in contact with his peers elsewhere in the country through his society, through his journal, and through travel to seminars and meetings. All of this area is most vulnerable at the moment in the Canada Council's budget, because it is the area where they have to cut, and can cut most easily, in order to protect what is their most basic research program.

This is particularly difficult on the humanist who, virtually, has no other source of support for this sort of thing. He cannot get any more money from the university, because of the university cutback. He cannot usually get this from foundations, and he cannot go and get contract research from governments. So, once again, I am making a strong plea that you should impress on the government that, from the point of view of the humanities at least, the present implicit policy that Mr. Drury has certainly made explicit, if not in writing at least in verbal communications to us all—that he will let inflation erode Canada Council support for university research—is very difficult and very hard on us.

That is all I should like to say. I shall not take up any more of your time this morning.

**The Chairman:** Thank you very much. I can see that there is a slight difference between the social sciences and the humanities, at least in terms of support.

We will now hear from Dr. H. G. Thorburn, President of the Canadian Political Science Association.

**Dr. H. G. Thorburn, President, Canadian Political Science Association:** Thank you, Mr. Chairman. I have just been elected president of this association, and I have not been around long enough to be terribly familiar with details, but I was the person who was asked about a year ago to write a report for the Healy Commission, which the Canada Council financed, on political science in Canada. That might help me in dealing with the questions.

**Senator Hicks:** Is that the paper which is before us?

**Dr. Thorburn:** No, that is a paper which I gave at the annual meeting of the Canadian Political Science Association and it includes some of the material from my other report. The other report comprised some 240 pages, and this is something like 12 or 13 pages.

**The Chairman:** The one you are speaking about is entitled, "Graduate Studies in Political Science in Canada, their Relationship to the Development of the Discipline and the Profession," is it not?

**Dr. Thorburn:** Yes. I think it would be appropriate if I were to begin my remarks by citing the resolution of the Board of Directors of the association which met in June of this year at Laval University. The motion was:

That the CPSA Board of Directors approves the proposals of the Social Science Research Council of Canada in its brief to the Senate Special Committee on Science Policy.

(1) That the government immediately remove its freeze on funds to the Canada Council for university research in the social sciences and humanities.

(2) That the government give urgent priority to university research in the social sciences and humanities.

(3) That the government should freeze or exercise restraint in its spending on in-house research in the social sciences and humanities, if this is necessary to achieve the preceding objectives; and

(4) That the government should create the new social sciences and humanities research council without further delay, and that the CPSA Board approves the immediate creation of the new social sciences and humanities council provided that it possesses at least as much independence as the Canada Council.

So you can see that without any prompting, and indeed before this meeting, the CPSA has largely stated a position which is congruent with that articulated earlier this morning particularly by Professor Loubser and also by Professor Brownstone.

We have a history of association with this committee. We submitted a report to you on June 10, 1969, a brief which is in very good shape in the sense that it has not yet seen its recommendations implemented by the Government of Canada, although we were very gratified at the reception it received from this committee.

I am somewhat worried about the time, and I am also concerned lest I repeat what has been said by people who have gone before me, so I shall make my remarks much briefer than I had originally intended.

**The Chairman:** We do not want to shorten your presentation, but perhaps it would help, if you have a longer document, to have it printed as an appendix to today's proceedings, so that this will be on the record.



**Dr. Thorburn:** Very well, sir. I will see that you receive a written copy of the notes that I have here, in reasonably finished form.

As far as the particular points I would like to emphasize are concerned, first of all, of course, I must emphasize the serious need for increased support for research in political science, using the general line of argumentation that has been used by those who spoke earlier.

Political science is a discipline in which you find that the bulk of the research done by university professors is carried out on the basis of funds provided by Canada Council. It is done to a lesser extent on funds provided by other bodies, but it is essentially based on the funds provided by the Canada Council.

Political science is also a discipline which includes areas that are of particular policy interest to government, and therefore some of our colleagues have been tempted to engage in a considerable amount of mission-oriented research, or commissioned research, mainly for government departments. This has created something of a problem within our profession, which I think has been described very well by our past-president, Mr. Donald Rowat in his presidential address, delivered in June. A copy of that address, I believe was distributed to members of this committee.

Essentially, the problem I refer to is this. With the diminution of resources going to the Canada Council for the support of research in political science, we are encountering a situation in which political scientists are being tempted to engage to a greater extent in contract research, and we feel that this is an undesirable tendency, since it tends to reduce general standards of research, and also to produce research of a much more applied and concrete nature than would otherwise be the case. This means, therefore, that the theoretical significance of the research, and the overall relevance of the research to the discipline of political science in general, is reduced, and this is clearly to be regretted. Moreover, the question of standards has to be looked at from the point of view of how the research is defined, and how the researcher is located.

In the case of independent research, it is the individual scholar who can conceive the problem, works out the research design and executes it. He assumes, personally, the responsibility for all of that, all of it is in the public domain, so to speak, and he is judged by his peers, through the mechanisms of peer-group assessment conducted by the Canada Council, in an entirely fair and competitive way. If he receives his grant, therefore, that is a vote of confidence that his own personal competence is accepted by his peers and the research design that he has prepared is accepted and is considered to be up to standards that the Canada Council has come to consider adequate. He then does his research, receiving funds from the Canada Council to pay, not his personal income—his salary or stipend—unlike the case of commissioned research, but merely his expenses, such a travel expenses, and, if he must engage research assistants, their stipends, and some secretarial and other subordinate assistants.

In the case of the other type of research, the commissioned research, there is no such competitive aspect involved. There is simply a meeting of people, usually a representative of the government department or agency, and the individual person, who may be a scholar or who may not be a scholar. The matter is then negotiated between the two of them. The research done is entirely

underwritten by the agency of government, and is submitted to government in its finished form to do with as it wishes. It turns out, in fact, that most of these reports are not published, they are not made known, and therefore they do not enrich the knowledge of the community, and the scholar does not have to be judged by them. His reputation, therefore, is not going to turn on the quality of that report.

You can see the effect this will have on a discipline if more and more of its members are being tempted into a situation where they can receive more generous financial returns, escape the scrutiny of their peers, and can prepare reports that need not be of publishable quality. The effect on the discipline in general could be seriously deleterious, and I would like, speaking, I guess for myself, to support what Professor Rowat said in his presidential address, deploring the growth of this type of research at the expense of the scholar-initiated, independent research, conducted under conditions of open competition and publication.

I think that perhaps this is more acute in political science than in other disciplines, although there are other disciplines in which it is more serious than in my own. That is a point that I think we might discuss at greater length, but I will, in terminating my remarks, merely cite some points which were in both Professor Rowat's paper and my own report on political science. These are summarized and are very brief.

The proposals that I would like to lay before you are six in number.

First, greater financial resources for the Canada Council and or its successor body, the Canadian Humanities and Social Science Research Council, if and when it is created.

Second, the payment of stipends to academics acting as principal investigators on research projects—in other words, to have equality of treatment between the two types of research. That already occurs with commissioned research, and I am suggesting that it might be applied also to independent research. I will go into that in greater detail; to justify it, if you wish, in discussion. This would permit them to apply to be relieved from teaching for a term or more at the beginning or at the end of a research project when full-time attention to the research work is necessary if it is to be carried forward at reasonable speed.

Third, financial support for research training institutes. These could be either summer programs on the campuses of several larger universities, where staff from both the host university and others could work with accomplished research scholars to elaborate and practise research methods and techniques; or ongoing research institutes could be set up, specializing in specific types of research, which could, with Council support, host professors on leave from universities to begin or complete research projects in the area concerned. This would both instruct and encourage the academics to get on with research, confident that they were fully informed of the best techniques and approaches, and with access to the best sources and facilities.

Fourth, the holding of conferences on research activity to develop new programs and methods of improving research activity. We should take positive steps to stimulate the cadre of academics currently in place to involve themselves deeply in research work. For better or for worse they are going to be there for a long time. A major concern of a research council is to take whatever steps are

needed to involve them in research, see that they receive the help that will keep the standards high. This will improve morale and thereby productivity.

Fifth, in view of the current "steady state" in which few new persons will be joining the academic community, there is need for stimulation via the distinguished research scholar program, which the Canada Council operated in the past. This program should be reinstated to encourage eminent foreign scholars to visit Canadian universities, so that our academic community can benefit from their ideas and example. That is because our scholarly community is not growing as a result of current limitations.

Sixth, there should be more than one federally-supported granting agency to support research in the social sciences. Monopoly is not a healthy state in most things. For the Canada Council to be virtually the sole source of support for independent research in Canada is not healthy. It would be advantageous if a scholar could apply to more than one agency as a form of insurance against the possibility that his application to one might be turned down because of the bias or excessively exacting standards of the particular referees consulted by the one council.

Also the existence of other councils would permit more experimentation with programs and, therefore, less conservatism than is inevitable with a single funding council. Perhaps a start could come about by leaving some responsibility broken up, when the new council is experiencing its birth and growing pains.

I shall stop there, sir, and consider any questions that anyone would like to raise.

**The Chairman:** Thank you very much.

**Professor Conrad Winn, Secretary-Treasurer, Canadian Political Science Association:** May I make a brief remark?

**Dr. Thorburn:** This is Professor Conrad Winn, who is the Secretary and Treasurer of the Canadian Political Science Association. He is a full-time professor at Carleton University.

**Professor Winn:** In the growing stream in which we live there is an increasing feeling that a lot of our research ought to have practical application. I do not dispute that. There is a growing feeling perhaps that, if we want practical application after all, it is the everyday working man, the government bureaucrat, who knows most about how to make social science practical. He really ought to do it, supervise it, or commission it. My point is simple, that actually not only is social science difficult, but practical social science research is even more difficult. You need the most competent people to conduct it. To do practical social science research within government is inefficient.

Professor Rowat's report shows clearly that the competence of social science researchers outside government is much higher. Therefore, if you want very good practical social science research, it has to be done outside. Not only is the competence of social science researchers higher outside, but you have a very significant social science community in Canada, one of the most significant in the world. If I could just mention the case of our own discipline, we have the third largest political science community on the planet. At the recent IPSA—that is, the International Political Science Association—convention in Edinburgh, Canadians presented the second largest number of papers; almost a third as many of the papers presented by Ameri-

cans. So you not only have better social science researchers outside government, but you have a very large community.

**The Chairman:** Are you speaking in absolute terms?

**Professor Winn:** That is correct. The third largest in the world in absolute terms, and the second largest number of papers, in absolute terms.

You not only have this fact, but you have world recognition of the competence of the Canadian social science community as revealed by the fact that the International Political Science Association is located in Canada, the World Association for Public Opinion Research is located in Canada, and I believe even the International Sociological Association may be located in Canada. Perhaps there are others.

The next point I would like to make is related to one already made previously, that is the free flow of information. It is not simply that information from our results, our findings, is made available broadly for policy-makers to use, not like the case of in-house research. It is not simply that. Speaking as someone who has been an "out-house researcher" for the Canadian government, the Ontario government and United States government, I can say frankly the problem of information is also internal. Researchers within government have more difficulty getting information than researchers outside. They have enormous difficulty getting information even from the directorate next door. From the point of view of efficiency, again, if you want practical applications of social science, the efficient way to do it is to do it outside.

**The Chairman:** You mean "leaks" go outside, but they do not go next door?

**Professor Winn:** Without naming my employer, I can say that I was employed to construct some research designs for a ministry in Ottawa. My major findings were that its complete apparatus was duplicated in another directorate, to the horror of the directorate employing me. Within a matter of a few weeks I had found out all sorts of information that the social science researchers employed full time were unaware of. They had a general fear of communicating within their own ministry. So it is a general problem. Information flows much more freely outside of government, and it is a much more efficient way to spend our tax dollars.

**The Chairman:** I thought that researchers within the government could always read the newspapers.

**Senator Yuzyk:** Perhaps they are afraid to communicate.

**The Chairman:** We have about an hour for discussion.

**Senator Hicks:** In view of the shortness of time, I do not propose in my questioning, Mr. Chairman, to take the submissions page by page, but rather to talk about a number of general points that have been raised, and to invite those who have made submissions from the three agencies to join in the discussion, rather than address questions to any one of them.

It is quite clear that the general point that you have all made is that you need more money, you each regard your discipline as deserving a particular priority and you refer, of course, to some passages in the previous report of this committee in support of that. Perhaps you could say as a caveat that unfortunately you are not the only people that have come to us and said your discipline deserves the highest priority. The medical people feel that way, the



general science people feel that way, and the so-called hard sciences seem to feel that way even though perhaps they may not be enjoying the crest of popularity they did two decades ago.

We have had a considerable amount of discussion here. This is the first topic I would like to invite a little more comment upon. We have had a considerable amount of discussion in the last few days about the position SCITEC can play in coordinating the activities, opinions and so on of the scientific community in Canada. In your brief Dr. Loubser, you make reference to SCITEC in a couple of places. What kind of a role do you think it is possible for SCITEC to play? A number who have been before us have agreed that it would be desirable if someone could, while not exactly speaking for the science community in Canada, at least provide a forum where the different disciplines could talk about their own problems, and perhaps develop some coordinated approaches to government. So it is not a question of your arguing that the pie is only so large, but the social sciences or human studies deserve a larger portion of it. Do you see any role for SCITEC? You are members of it, are you not?

**Dr. Loubser:** Yes, the Social Science Research Council is a member. We participate actively. We have supported SCITEC from the beginning. We have never had the kind of reservations that some sectors of the scientific and technological community have had about the role of SCITEC as a possible spokesman for science. In fact, we have attempted in the past to liaise as much as we can with associations with a broader base than we have. I am not talking only about SCITEC. I am talking about the Association of Universities and Colleges of Canada, the Canadian Association of University Research Administrators. We have worked with CAUT who also speak on behalf of the whole scientific community and the humanities. We have very little reservations about the fact that SCITEC could develop a meaningful role as a spokesman for the scientific community if it is able and has the orientation to establish the necessary means by which it can make a meaningful statement.

**Senator Hicks:** The SCITEC people when they were before us were quite careful to point out that they did not expect to speak for the physicists, or the social scientists in Canada. They expected each discipline would speak for itself. They would play a coordinating role or provide a forum for it. On the other hand, the engineers who were before us criticized SCITEC most stringently for this very reason, and have said they are not going to allow SCITEC to speak for the engineering profession in Canada. However, when the SCITEC people appeared here, they said, "We do not wish to speak for the engineering profession".

**Dr. Loubser:** I think SCITEC is right. The engineers have systematically failed to pick up that connotation from SCITEC, as I believe Senator Lamontagne's files will demonstrate adequately, and as will the public record of SCITEC, that it does not wish to speak on behalf of the engineers. We have a similar position in the Social Science Research Council; we make our statements.

**Senator Hicks:** And you do not wish the Royal Society to speak for you, either.

**Dr. Loubser:** Yes, but there are very different reasons for that, as you can imagine. However, in the social science community we have for many years had great difficulty in getting our various member associations to accept the

spokesman role for the SSRCC. They have now accepted it because, I think, we have proven over the last few years that we can make meaningful statements with respect to the interest of the social sciences community as a whole. However, at the same time we do not presume to speak for the Canadian Political Science Association and they are totally free to say that they endorse what the SSRCC has said, as Professor Thorburn has this morning, and that they have additional concerns.

So that, from our experience, we are quite confident that an association such as SCITEC can play a meaningful role as the spokesman for the scientific community. I might say that at present I am a member of the council and the executive of SCITEC, and have over the past year urged SCITEC to establish a science policy committee which SCITEC, curiously, has not had in the past. The reason given was, "Well, SCITEC itself is about science policy". You know how these things happen; if you have 110 other things, that falls by the wayside. So, finally, in April they decided to establish a science policy committee with exactly these intentions, to coordinate science policy concerns of the various associations, and to see what are common elements and what would be the best for the scientific community as a whole, and then to give the member associations a chance to endorse or not endorse what comes out of that.

Being told, as I put forward the idea of forming the committee, that I should chair it,—I still do not know how we will do it, but a number of competent people have agreed to serve, and I think in this area, at least, SCITEC has now put a mechanism in place which might begin to provide that overall perspective on science policy concerns.

**Senator Hicks:** We are very glad to hear that. What about the Humanities Research Council—is it a member of SCITEC?

**Dr. Steedman:** No, as far as I know, none of the humanities associations, nor the council, as a matter of fact, are members of SCITEC as an organization. However, as an individual I am a member of SCITEC, just to keep my eye on what is going on, but the humanities are not included.

**Senator Hicks:** What about the Political Science Association?

**Dr. Loubser:** The only two members of the SSRCC who are members in their own right are the psychologists and the geographers, and you know these are the main scientific components in those associations who do not consider themselves to be social scientists.

**Senator Yuzyk:** You report that there was some progress made in SCITEC, but has that progress been sufficiently fast to satisfy you that these problems which concern you are being dealt with adequately as situations arise?

**Dr. Loubser:** I do not believe SCITEC has reached the take-off stage.

[Translation]

**Mr. Pierre Savard, Outgoing President, Humanities Research Council:** Mr. Chairman, I think that this SCITEC question is an important one and I would like an understanding to be reached here. I too am a member of SCITEC. I became a member in a rather roundabout way. The Association canadienne française pour l'avancement des sciences, of which I am a member, delegated me to SCITEC, saying: we need people other than scientists to

represent us. Since I have been attending the meetings, I have been asking myself seriously what I, an historian, am doing there. If SCITEC did in fact claim to represent Canadian science, in the broad sense of the word, I think that as former president of the Canadian Council for Research in the Humanities, I would vigorously object. SCITEC should, one day, define its role. Let us suppose, for example, that it was no longer allowed to speak on behalf of scientists and was increasingly dominated by scientists. It would then have to take refuge in more elevated and tranquil zones and refer to science in the broad sense of the word. However, I think that to us, in the humanity field, this is inconceivable. We must know where we stand in this matter. In other words, we do not want to eliminate the humanities, or the social sciences, since they should be included in a broad concept of science which, eventually, would cover everything.

**The Chairman:** I find the comments made concerning this committee very encouraging in the sense that, if it is possible to organize a forum to determine how much of a consensus can be reached as to what the priorities of the government's scientific policy, etc., should be, the humanities too could profit from such a dialogue.

**Mr. Steedman:** As part of a forum, yes, but as a representative?

**The Chairman:** Yes.

[Text]

**Senator Hicks:** Each of you in your briefs has expressed the hope that the new granting councils would be established promptly, and so on. However, I was most interested in the final remarks made by Professor Thorburn with respect to the new granting council, and the need to have more than one agency to which persons could apply, suggesting even that the Canada Council might retain some of its functions in this area.

You may, or may not, know that I myself believe there is no advantage whatever in setting up the new councils. I believe that what has been wrong with the granting agencies to date is that they have not had sufficient money, and that you could correct this by giving more money to the existing councils just as easily as you could be creating new councils.

Now, I know the history of the humanities and social science people in contest with the Canada Council. Initially, I suggest, you proceeded on a wrong assumption that if you could have a council of your own you would exercise more control over it, and so on. I suppose your feeling is that if you have a council that concerns only your own discipline you will get more money but in the meantime you will add to the bureaucracy. You all believe in a system of peer evaluation in dealing with applications. You have exactly the same pool of people to draw from to take up these committees, and I do not think you will change it sufficiently by merely creating a multiplicity of councils.

Furthermore, Professor Thorburn, while I do not wish to put words in your mouth, I make the proposal to you that it is unreasonable to expect the Government of Canada to create a multiplicity of granting agencies of this type. It means that they will lose control of their budget, or will be more likely to lose it than if it were through one agency. I can see why an applicant would say, "Well, if I am going to either one master or the other, I will have a better chance

of succeeding." However, I wonder if it is actually realistic for us to expect that to occur?

**Dr. Thorburn:** I made the proposal, and I am not the only one who has ever suggested it, thinking that it was a sensible thing to do. What is a sensible thing to do and what may be realistic may not be the same, as we know. I think you have repeated the reasons I gave for this suggestion quite well. They are essentially that one particular granting agency may have a particular approach. We noticed recently that the Canada Council has not simply acted in a bureaucratic fashion—that is to say, waiting for applications to come and processing them in this kind of impartial way. It has developed policies in the sense that it has now these special negotiated grants. Its program is to encourage inter-disciplinary research, which is competitive, of course, but it is special and the Canada Council, therefore, has undertaken to decide what areas are somewhat neglected, which should have special help given them and, therefore, which ones will not be given this particular extra boost. These are policy decisions, really, which may be supported by some members of the various disciplines, but they certainly will not be by those who are disadvantaged.

My point really is that I think this kind of initiative is a good thing, provided it is not exercised by an organization which possesses a monopoly. Once it possesses a monopoly and undertakes policy decisions of this nature, it is getting to the point at which its actions could be seen as incorrigible. They could become highly discriminatory and, therefore, could undermine confidence in the body.

I would be inclined to say that either the Canada Council should abandon these special programs—which I would regret—simply in order to be completely impartial, or else there should be another body which could undertake other initiatives so that we will have the healthy effect of competition and new approaches. I see no reason why the government of Canada should eschew a duplication in this area, since it has shown its willingness to duplicate in others.

**Senator Hicks:** Are you really serious in saying that because the Canada Council has developed some special programs and incentives like this it may be neglecting meeting the needs of the so-called free research applicant? For example, the National Research Council has done this through its negotiated development grants, major equipment grants and other devices for many years, and I have never heard anyone from the hard scientists suggest that these policies of NRC had prejudiced its dealing with the normal applications that came to it.

**Dr. Thorburn:** I am not suggesting at all, sir, that the Canada Council has shown prejudice against particular kinds of applications, but the resources are appallingly limited and, if some of those resources are to be earmarked for special projects, what remains already inadequate will become more inadequate for the other areas.

**Senator Hicks:** It comes down to the same point that we really need more money to do a good job, through whatever agencies we choose.

**Dr. Thorburn:** That point remains significant and important. However, I do not withdraw my suggestion.

**Senator Hicks:** Very well.

**Senator Stanbury:** Mr. Chairman, in the health research area there are two bodies—NRC and MRC. We found out



yesterday that the difference between which one you apply to is a question of how much money you expect to get, because the grants from MRC are about double the size of the grants from NRC. Particularly in view of Professor Thorburn's suggestion, that is an area where we can study the question of whether the existence of two granting agencies is a hindrance or an advantage.

**Senator Godfrey:** I would comment that the Canada Council, on the arts side, did run into some competition with the Local Initiatives Program. The result of that competition was that if you wanted a lot of money you applied for a LIP grant. It could be for something which could not possibly qualify in terms of competence, or in any other way, with respect to the Canada Council, and yet you would get a great deal more. Some small theatre group consisting of a few people could start up somewhere and get a LIP grant, and then later they could go to the Canada Council in some cases, because by that time they would be competent enough to qualify for a Canada Council grant.

**Senator Hicks:** So the LIP grant was justified after all.

**Senator Godfrey:** In certain cases it served a useful purpose, but the money going via the Local Initiatives Program to people who were not as well qualified as those applying to the Canada Council was out of all proportion.

Dr. Thorburn, I was rather interested in a letter written to the Prime Minister on January 13, 1975, by your predecessor, Mr. Léon Dion. In the second paragraph on the second page he says that for the reasons mentioned in his letter of October 4th, it is necessary that all members of this council be university people.

I was also on the Canada Council and I am quite sure I agree with Senator Hicks, because my experience on the Canada Council was that, in effect, it was divided into two councils. When I was first on the council they had the academic side, and they used the word "academic" in the bylaws. It was an academic subcommittee of the members of the Canada Council, and there was an arts subcommittee as well. The academic subcommittee consisted entirely of professors or university administrators. There were no laymen on it whatsoever. They went off to meet for a day or a day and a half by themselves, and the arts side would then meet as well, but it met not only with artists but also with a sprinkling of laymen or people representing the Philistines, like myself.

It took me a year and a half, but I managed to get a bylaw passed to change the name of the academic subcommittee to the "Social Sciences and Humanities Subcommittee," and to get one laymen on that subcommittee. It was over strong objections, I might say. The layman happened to be a lawyer, but I managed to sneak him on because he was also the chancellor of a university. I guess they felt he was acceptable.

**Senator Hicks:** He was close to the academic taint.

**Senator Godfrey:** I believe that if war is too important to leave to the generals, the universities and other similar areas are also too important to leave to the professors.

I would just like to quote Sir Eric Ashby who said, "A university run by professors becomes a university run for professors. If all students were being trained to become professors this might not matter, but the function of universities is to put the administration of human affairs in the hands of educated men, and professors are not very

experienced about human affairs." I agree with that. I think it applies equally to this new council. Why should it consist entirely of professors? Should not the public be represented?

**Dr. Loubser:** I agree with your position, and I think that is the official position of the SSRCC. As a matter of fact, we are on record in our brief to the Prime Minister that while we welcome the idea that the council will be governed by professionals in the humanities and social sciences, as he put it, there will also be a representation of the fabric of Canadian society, as we put it, from various walks of life. We put great importance on that, and we would not ask for a council made up exclusively of academic social scientists.

**Senator Hicks:** Since you started off by saying you differed with me in this respect, Senator Godfrey, I want to stress that I entirely agree with your construction of this. I deplore this development which was starting in the Canada Council just as I left it.

**Senator Godfrey:** I almost feel from my experience that we have two councils in the Canada Council, and there would not be that much significance if you suddenly erected a partition and had two staffs.

**Senator Hicks:** Provided you did not duplicate the staff from the office boy to the director all along the line.

**The Chairman:** That was made clear in our report. I wish we could reduce this dialogue between two former members of the Canada Council because, since I had a great deal to do with the establishment of the Canada Council, I might also wish to join in.

**Senator Godfrey:** The next thing the political science people say is that these people must be free of any partisan ties in order to be qualified as members of this council. In other words, political scientists believe that only political eunuchs should be appointed to this council. At what point would it take Senator Hicks to become purged of the fact that he was once the Premier of Nova Scotia so that he could be qualified for this council? Why do you feel, just because you happen to have taken an active interest in politics, that that should disqualify you from discussing things like political science.

**Dr. Thorburn:** That is not my statement, and I do not happen to agree with what you have just cited.

**Senator Godfrey:** Do you mean the letter?

**Dr. Thorburn:** That is right.

**Senator Godfrey:** That is what I wanted.

**Dr. Thorburn:** Somebody who has been a member of the Liberal Party should certainly not *ipso facto* be ruled out of consideration.

**The Chairman:** We would have to get rid of all of the NDP people.

**Dr. Thorburn:** I think what was meant, really, was that blatant political appointments should be done away with.

**Senator Godfrey:** And I agree with that entirely. Nobody wants that, but I wish they would state with more precision that in order to get rid of political hacks you do not have to eliminate former premiers of provinces.

Then you say that it must be perfectly autonomous.

**The Chairman:** Pardon me, Senator Godfrey, but what are you referring to now?

**Senator Godfrey:** The letter to the Prime Minister dated January 13, 1975.

**The Chairman:** Thank you.

**Senator Godfrey:** I can remember attending an emergency meeting of the Canada Council, called solely to emphasize that they had to be completely and absolutely autonomous. I said, "You're just day-dreaming. When you lived on your income in the early days, you could claim to be autonomous, but once you became dependent on yearly grants from the government, you lost your autonomy."

I discovered, for example, that they had never once asked the Secretary of State, upon whom they were dependent for their funds, to plead their case in cabinet, and that he had never met the Canada Council. He was someone who was unclean, unwashed, or something, and on my insistence he actually came to a meeting and saw how we operated, and even had lunch with us. We showed him how things were by showing him how sparse the lunch was. He got sandwiches and a couple of cups of coffee.

This idea of complete autonomy, however, for anybody who depends on government, is a myth, in one respect, although I never saw any evidence of political interference as far as the Canada Council was concerned; in spite of the fact that they could not really be considered autonomous, they did not keep their political fences mended.

**The Chairman:** I think that what Senator Godfrey is saying now is quite justified. Going back to the establishment of the Canada Council out of this endowment, I think I was mainly responsible for providing in the act that it would not be an agency of the Crown. At the time it was, as Senator Godfrey has just mentioned, perfectly justified that the council should be conceived in that way. I was the minister at that time, however, and when they came to me for an increase in the grant in terms of an allotment from Parliament, I told them, "If you start this, I could well go back to Cabinet and ask for an increase in your endowment which will protect your status as not being an agency of the Crown, but the moment you start to have, or rely more and more on, appropriations from Parliament, you will have to be responsible in some way to Parliament."

I think, therefore, with this in mind, that it is unreasonable for this new council to ask not to be an agency of the Crown. I think it should be exactly at the same level, or have the same status, as the Medical Research Council, the new granting council, and the National Research Council. I do not think we have received any complaint here about political interference in the affairs of the MRC or the NRC.

**Dr. Loubser:** Mr. Chairman, I would like to confirm what you have just said. I think the SSRCC initially, in its recommendations to the Prime Minister, strongly urged that it not be an agency of Her Majesty. This notion ran into very strong opposition, the argument being that it should be a category B departmental corporation. We then made a comparative study of the legal status of the Medical Research Council, the National Research Council, the Canada Council, and certain other crown corporations, and came to the conclusion that the formal status of "not being an agency of the Crown" is a fiction. It is subject to exactly the same constraints as the other granting councils, and the report that came out of this study is appended as an appendix to our brief. I think, if you will take a look at it, you will see that we eventually came to the conclu-

sion that the particular legal status of such bodies is not as important as the way the council is operated right from the start.

**Senator Godfrey:** The one advantage, and it is a practical one, of not being an agency, is that you can carry money forward for a year, and average things out. If you heard there was going to be a freeze or a cut in the next year, you could save a little from this year. That is what the Canada Council did, and it was very helpful.

**Senator Yuzyk:** While we are on fund-raising, I think it is very important that we should keep in mind the fact that education is under the jurisdiction of the provinces, and that a lot of our research work is done by universities, which are provincial institutions. I am sure you must have thought about the role of the provinces and the funding of such councils as this, or of the new council, or even the Canada Council. They do have a contribution to make to the Canada Council and to the new council, as you are suggesting here, not only financially but also from the point of view of scholarship, as such. Do you have any suggestions regarding the role of the provinces? I certainly think they have one to play.

**Dr. Thorburn:** Yes. I would, however, like to refer to the past. When I was connected with the SSRCC, I remember making a pilgrimage to the provincial capitals to try to enlist the provinces in the support of and participation in our activities, thinking that this would be a means whereby the provinces would have something to say about research, and would make a contribution to it. I regret to say that nothing came of that, but I still believe that the provinces, through their responsibility for education, could very well undertake in some degree—a degree to be determined of course, by them—to support research. I am thinking now of the social sciences, of course, but I see no reason why this should be limited to that field. I would, myself, welcome the setting up of research councils by the provincial governments, and this has already been done in Quebec, as you know.

**Senator Yuzyk:** It is the only one, I think.

**Senator Bell:** British Columbia has a research council.

**Dr. Thorburn:** Ontario does not have a research council, but there are ways in which the Ontario government makes funds available.

**Senator Godfrey:** The Ontario Research Council was founded in 1927.

**Senator Hicks:** There are provincial research councils, but not of the nature of the ones we are talking about. The only one that does anything significant in the way of providing supportive grants for research is Quebec at the present time, I believe. The Provincial response can only be described as disappointing to date.

There is one other small question, Professor Thorburn, that I want to direct to you. You referred to the usual non-publication of research which you described as commissioned research. It is possible for the research worker, I believe, however, in his negotiations with the department concerned, to insist on, request, or negotiate for publication, perhaps after a reasonable delay. Will you comment on this? I take it this is not a common practice, though I happen to know of a couple of examples of where this was done, and where it was negotiated quite successfully. I am wondering if the academic community is trying hard



enough to stipulate in their arrangements that publication may follow.

**Dr. Thorburn:** You are speaking of a negotiation carried out privately, essentially, between two persons—namely, a researcher and a commissioner or sponsor. What goes on between them is really not open to general review. We do know, however, that some royal commissions, and other commissions of inquiry, have agreed either to publish the report or allow the researcher to do so if the commissioning agency declined to do it.

**The Chairman:** We had a very good case here in the Senate. When the Senate committee had certain researchers in its service, they produced their report before the Senate committee did.

**Senator Godfrey:** After they had resigned.

**The Chairman:** And they published it.

**Senator Godfrey:** Yes. It was a real report on poverty.

**Dr. Loubser:** I must say that I think I have a slight difference of opinion with Professor Thorburn on this. Contract research is not always necessarily done in that fashion, and that is why, from the point of view of the SSRCC, we are very much concerned about influencing policies and procedures in terms of which contracts are let and evaluated, and so forth, and I can cite two government research programs that now come pretty close to having established a peer review system. It is not quite what it ought to be, but with respect to both peer review and publication, the situation I have referred to begins to meet our concerns. One such program is in the Solicitor General's department, that has established a guide to its research programs. It establishes priorities on a yearly basis and invites proposals. It then has the research reviewed by committees of experts in the areas concerned.

**Senator Hicks:** But what about publication?

**Dr. Loubser:** They also are committed to publication of their reports.

The other department I had in mind is the Department of National Health and Welfare in its Welfare Grants Program, which actually has a system by means of which they have separated methodological considerations, relevance considerations, and significance considerations. With regard to significance, the criterion is usually the merits of the contribution to scientific knowledge. With regard to methodology, the criterion is as to whether the right methodology has been used. With regard to relevance, the criterion is as to whether it is related to the objectives of the department.

In all three of these cases they have panels of outside experts who advise them independently, and they make a decision after. In some areas there are procedural developments that eliminate the dangers of the contract route that Professor Thorburn has highlighted. While these programs provide ample opportunity for quite significant research and contributions to the disciplines, they still do distract people to some extent from independent research because of the inequality of the fees payable under the two systems.

**The Chairman:** We have received several representations during the last few days about applying the peer system throughout the intramural program of the government. We have even received a proposal that the assess-

ment of this peer system, even for intramural activities, should be published. What would be your opinion of this?

**Dr. Loubser:** Personally, while the Social Science Research Council has not come to a position on this, although it is a matter under study at the moment, I think we are not saying that there should not be intramural research. We know it must be there. It must be competently done and the more in public and in the public domain the better. We are most interested in influencing procedures and policies whereby the quality and the public availability of that research would be secured. Certainly this type of operation, whereby academics could be involved in assessment of the significance of research proposals, would meet some of the concerns that Professor Conrad Winn has expressed and we all share, that it will become a way of upgrading the quality. I think the SSRCC will very shortly be in a much better position to provide departments with referrals to competent assessors for such research when we establish our directory service for social scientists this fall.

**Senator Hicks:** I drew attention to this problem in order to bring about exactly what has happened—that is, the suggestion that your councils or your individual research workers ought to try harder to negotiate acceptable terms in contract research, including the rights to publication—sometimes modified and controlled, as can be understood—and also support, as you all do, the application of peer judgments as far as possible of in-house research as well as of research contracted out or undertaken in any other way.

**Dr. Loubser:** As you know, there are several codes of ethics for associations like those of the sociologists and anthropologists that actually restrain professionals from research when they cannot publish it. Several universities have guidelines for research by which they will not allow their members to undertake research that is classified.

**Senator Hicks:** One has to be careful here because in the national interest there are some types of research under certain circumstances that may have to be classified. I do not go all the way with some academics in forbidding the university or personnel of the university to engage in classified research.

**Senator Godfrey:** There was also a publication problem, as I recall, with respect to Canada Council grants for research. It is not that they were not permitted, but that they did not. There was no way to follow-up to see what did happen, except that when they came along two or three years later and applied for another grant for something entirely different, you found out that they had not completed their research on the first subject. You caught them at that point. I do not know how serious a problem this was; I cannot remember. I remember that the Canada Council was giving grants and never knowing what happened—whether the work of the recipient resulted in publication, or whether he took the grant and went off to Europe on a holiday.

**Senator Yuzyk:** There has been some improvement because they do require a report after a project has been completed and, also, the prospects for publication.

**Senator Bell:** Mr. Chairman, there are two threads that consistently run through what many of the witnesses have said. I wonder how the social scientists feel about them. One concern is the stability of funding, and the other is the need for a clear statement of national policy. This comes

from the medical scientists, the engineering scientists, and people in the private sector. How do those two threads come out in your woven cloth?

**Dr. Loubser:** It depends on how you define stability. It seems to me that in the social sciences, in particular, we are only now beginning to build up the research teams and the institutions that can make a cumulative effective effort at putting some order in our knowledge about some aspects of the society. One representation here this morning noted the problem of lack of stability in funds provided at the institutional level for that kind of work. We are more at the stage of arguing not for a policy to enable us to maintain stability, but a policy that will provide us with resources to begin to build up institutions that can maintain a systematic effort over a number of years to accumulate, digest and disseminate knowledge in particular areas. Our concern with the second matter is equally clear. I have stated this morning that one of our great concerns is that we cannot see far down the road to just exactly what the government commitments are with respect to social science research.

**Senator Bell:** These two threads are important in your mind?

**Dr. Loubser:** They are very important. This is one example where I think the scientific community will speak with one voice, if you could bring them together and give them an opportunity to articulate it.

**Senator Bell:** Dr. Steedman, would you concur?

**Dr. Steedman:** Yes. In the humanities we put the emphasis more upon a question of the National Library policy, the question of a national inventory of our research, the whole problem of bibliographies. We just do not have them. We have to begin. We are also in the very early stage, really, if you compare our national institutions with those of almost any other major Western country.

**Senator Bell:** At the other end of the scale, we have Professor Brownstone, who probably would concur.

**Professor Brownstone:** I certainly would concur.

**Senator Hicks:** That is what he is being threatened with now, instability of support.

**Professor Brownstone:** As my colleagues indicated, we have made more progress along the line than perhaps some of them in developing a research and information thrust. But, as has been indicated to us, we are now threatened with extinction. One of our important projects was the design of an urban information system which is almost entirely lacking in Canada. We spent considerable sums of money in doing research into this problem and designing a system. Unfortunately, at the end of the road, there was no support for it. So we have in our hands a design system for information which fits in closely with the comments made about our National Library policy, a national inventory policy, and so on. Unfortunately, there was no support to implement this very sound, basic kind of suggestion.

**The Chairman:** I am a little confused about this complaint of lack of support and the statement we heard a moment ago that we were the third country in the world in terms of the number of social scientists, and that we have already attained a high international reputation. This does not seem to be consistent with the very pessimistic outlook you gave in your longer paper, professor.

**Professor Winn:** The answer is that we have extraordinary instability and lack of foresight in overall planning in research in universities. I believe it is clear that we have too many social scientists right now, and that this will affect us in terrible ways for the future. Our president keeps reminding me that in 25 years I will still be the youngest political scientist in Canada.

**Senator Yuzyk:** That is stability.

**Professor Winn:** So the problem is that we have an enormous surplus of academics, and that we will not have new ones entering our professions for many years to come. That is one problem.

The other problem is the government's lack of understanding in terms of the efficient use of resources. It is clearly inefficient to allocate all these resources to under-trained people within government, and to ignore the over-trained and oversupply of overtrained people outside government. That is my answer.

**Dr. Thorburn:** May I supplement Professor Winn's comments? The reason for our large number of political scientists goes back to the 1960s, when we were increasing the number and size of our universities at a rate never seen before.

**Senator Yuzyk:** Phenomenally.

**Professor Thorburn:** Perhaps we overdid it, but who overdid it? I do not believe that we can really blame the community of scholars which came into being, in a sense, in response to this staffing bonanza. However, if these people are now in place, and if there is a function, they must be supported. If you look at the average grant going to these people, it is something in the order of \$800 a year. How much research, how much travel and how much staff can you employ for \$800 a year? The answer is pretty obvious. That is simply taking the total number of political scientists, a number in excess of 600, and dividing it by the amount of grants made by Canada Council. Clearly, only a small minority of those people receive grants and are therefore able to function as research scholars with government support. It is possible to work without government support also; I am not saying it is not. However, it seems to me that if we are to get value for our money—we are spending a great deal on employing these people seeing that the average salary must be something in the order of \$20,000 a year—we must support them to more than the extent of \$800 for doing their research, which is really the major purpose for their being there, their teaching and research being their two essential functions. They can teach all right, but to do research with that kind of support is extremely difficult and, I believe, suggests that if we are to get value for our money we need to put a little more money into research.

**Senator Godfrey:** As a layman, I do not understand why political scientists, particularly in the Canadian context, must have money for research when there are plenty of libraries available. I could understand if they were studying the Constitution of India and what is happening there they may need to go to India, but why do you need so much money?

**Dr. Thorburn:** This turns on the development of techniques for research and also on the use of old techniques. One of my colleagues has received approximately one-third of a million dollars as a political scientist to do studies on Canadian elections. Now, this involves surveys, which are



very costly and have to be subcontracted, as you know, to firms which specialize in that activity.

Other types of political science research that are costly are large-scale co-operative research arrangements, which involve the hiring of research assistants and which cannot be done without them because of the scale involved. Then, of course, there is the question of travel. If you are going to study South African politics, you pretty well have to go to South Africa, which costs money, and you have to stay alive while you are doing your work there and, therefore, you must have a stipend of some kind for the period you are there.

So, essentially, it is not really a matter of reading what other political scientists have already written and commenting on it or, indeed, looking at election returns or other published government material, but rather of initiating information and research, which is costly, given modern research techniques.

**Senator Godfrey:** I must make one comment. One political scientist wrote a book on the financing of political parties in Canada and never once spoke to me, who was for some time the chairman of the finance committee of the National Liberal Federation and who might have been able to tell him a few things.

**The Chairman:** Perhaps he would regret it today.

**Senator Godfrey:** I left Toronto and came to Ottawa, and after I read his book I was amazed. I even read the Barbeau committee report and some of its studies with the stupid factual mistakes that were made because they had not bothered lifting up the telephone and talking to someone like myself.

**Senator Hicks:** There is a little danger in the type of conversation we have been having with respect to political scientists recently, and the underlying assumption that political scientists exist only to engage in research, or that they exist only to produce further political scientists who will do research.

After all, the study of politics, or political science, or whatever you wish to call it, is an extremely important element in the education of any person in the kind of society in which we live today. It ought to be pointed out that we have really been talking only about the graduate student and his work in political science. The limitations that we imply relate largely to graduate work and to the portion of the time of the professor who we all agree, even if he is only teaching at the undergraduate level, should still be engaging in some research.

**The Chairman:** What about the brain drain and the brain gain?

**Dr. Loubser:** I do not know whether we should open up that question at the moment. It seems to me that the question of the employment of non-Canadians in Canadian universities has now come to a point at which the provinces, the universities, and so forth are taking positions which have certainly arrested the rapid brain gain that we needed during the 1960s in order to achieve the kind of expansion that was necessary. At the moment, we face a fairly tight and almost closed academic market. I think increasingly the mechanisms are being put in place to make sure that the surplus of qualified Canadians that we are now able to produce, just as the market dries up, are not in unfair competition with people from the outside.

Whether the mechanisms are adequate and whether the federal government will do something about this, I am not sure.

I believe some of our associations, particularly the CPSA, have had almost the opposite concern—not opposite, but a concern that the implementation at least of our immigration policy has recently operated against the entrance of academics to Canada that they would like to see. So it is a very complex question.

**The Chairman:** What about the brain drain? Are we losing many good researchers to the United States, or elsewhere?

**Dr. Loubser:** I do not believe we have the information. About two months ago we happened to have an interview with Mr. Drury with respect to the research priorities and he was very much concerned that no one can give him reliable forecasts or information as to the situation with respect to highly qualified manpower requirements in Canada, because in his view that is the primary consideration in determining how much money he should spend on research.

The problem is that it seems that the federal government has not put in place the mechanisms needed on the part of MOSST, Statistics Canada, and Manpower and Immigration to really develop adequate knowledge and policies with respect to the highly qualified manpower requirements of this country.

Mr. Andras has recently blamed the universities for not projecting the manpower requirements properly and, therefore, over-producing in some areas. Mr. Drury tried to blame the scientific community for not regulating access to the community, and the production of more people oriented to the universities.

I would like to say that I think the implementation of the recommendation that this committee made in its report that the federal government to put in place the mechanisms whereby we can begin to develop adequate knowledge about our highly qualified manpower requirement forecasts, and translate that into admission, access and scholarship policies, is long, long overdue.

**The Chairman:** Because, surely, this is a joint responsibility.

**Dr. Loubser:** Absolutely.

**The Chairman:** It should not be asked only of the universities or the scientific community.

**Dr. Loubser:** May I say something about the priority question Senator Hicks mentioned earlier. Other people say, "Give priority to us." I can point out that, if you look at the figures in the granting councils, the amounts of research grants paid out to university staff and work out a per capita situation—which has some weaknesses as you may anticipate because in the humanities and some fields of social sciences our work is not quite as capital or labour intensive as it is in the life sciences and the natural sciences; at least, we have not been thinking about it that way in the past—it is a fact that our average per capita grant is about one eighth of NRC's and about one tenth of MRC's. You cannot explain that simply in terms of qualitative differences between different types of research.

**Senator Hicks:** One would have to agree that your figures do show that you are pretty low on the totem pole.

**The Chairman:** I agree with this point completely. But I have made some calculations which I think provide a more direct comparison between the different disciplines, and which show that the way you have calculated your relative share tends to maximize the disequilibrium. Let us make some direct comparisons. If you go to Table I and look at the total federal budget for scientific activities, you will see that they have increased from 1971-72 to 1975-76 by 46.7 per cent. The human sciences scientific activities increased in the same period by 89.3 per cent. So there is an improvement there, at least. Then if we look at the total federal budget for research and development we see that during the same period it increased by 48.3 per cent. For human sciences research and development it increased by 130.7 per cent. If we look at total federal budget for extramural R & D, we see that that increased by 45.8 per cent. Then the human sciences extramural R & D increased by 160 per cent. The human sciences research and development performed by universities increased by 76.9 per cent, while the Canada Council R & D support increased by 100 per cent.

That kind of calculation gives a better and more realistic picture of what has happened than the percentages you have used in your brief, and again I say that while this method of comparing the figures appears to show that there has perhaps been more progress than you claim, nevertheless, to me your claim remains completely valid.

**Dr. Loubser:** Mr. Chairman, I deliberately did not use the method of calculation or of making comparisons that you have suggested, because it is about the weakest form of statistics you can use. Let us take the example of one person receiving \$100 and another receiving \$10. Each one is given a \$10 increase. For one it is a 100 per cent increase, and for the other it is a 10 per cent increase, but you are

not stating anything about the relative positions of the two. With respect to your question of the relative priority being given to the social scientists, the kinds of statistics I have given you are the proper ones.

**The Chairman:** I think that we also have to look at the absolute figures.

**Senator Hicks:** We do not really differ in principle or in our total evaluation of the situation.

**Dr. Loubser:** Your figures show how much more effort is needed.

**Senator Hicks:** I had a number of other small questions, one or two of which are facetious and would have been amusing, but in view of the time I will forego asking them now.

**The Chairman:** I am sure the messages we have received this morning will be well received by the members of the committee, and I hope that through our next round of recommendations we may be heard more effectively in certain areas than we were in 1972 and 1973. We have realized throughout this new round of enquiries that by asking some of the government departments to return before us we have caused them to start reading our 1972-73 report. As a result they have moved in the direction of applying certain of our recommendations. Perhaps our revisiting the field at this stage is useful, then, in the sense that some people at least have started to read.

Thank you very much.

The committee adjourned.





Appendix "48"

BRIEF

TO THE

SENATE SPECIAL COMMITTEE

ON

SCIENCE POLICY

1975

SUBMITTED BY

THE CANADIAN COUNCIL ON URBAN AND REGIONAL RESEARCH

December 11, 1975

To: Senate Special Committee on Science Policy 1975  
From: Canadian Council on Urban and Regional Research  
Re: Implementation of Science Policy: Urban Studies

Introduction:

1. The Council welcomes the invitation from your Chairman to assess progress since our last submission to you, in the light especially of the recommendations in Volume 2 of your Report (1972). Our predecessors (Messrs. Jean-Marie Martin, Eric Beecroft, Peter Dobush and others) appeared before you on 12 June, 1969 and their testimony appears at pp. 7339-7410 and 7468-7487 of your Proceedings. Our present comments are submitted within the framework of what was then said in this Council's behalf and within the context of the recommendations your Committee subsequently made. The disparity between our common convictions and subsequent official action in the field of urban studies in Canada leads us, at the end of this submission, to enter a few very urgent pleas to save the situation.

The Council's Position:

2. The Canadian Council on Urban and Regional Research was set up in 1962 as a mediating focus between those with responsibilities in urban affairs (at all levels of government and in the private sector) and those willing and able to add to the stock of intellectual capital to be applied to urban problems in Canada (mostly in the professions and universities). In its first eight years the Council was funded with slightly over a million dollars, of which two-thirds came from the Ford Foundation and nearly all the rest from the Government of Canada under the National Housing Act; small amounts came from provincial, municipal and private sources. Financial statements omit the

substantial value of voluntary energy devoted by all those Canadians who have taken part in the Council's work. That work resulted in attracting good minds to the challenge of urban problems, supporting the best of them with modest grants and scholarships (which took most of our money), holding dozens of seminars across the country to share research plans and results, and instituting a computer-based bibliography of hundreds of Canadian urban publications and research reports from all sources. Always there was an eye to the policy implications of investigations considered. Competent and independent observers have said that seldom did so little money generate the application of so much talent and the release into the public domain of so much pertinent knowledge.

3. In our previous submission to the Special Committee we stressed:
  - a) the urgent need to overcome the neglect of peculiarly Canadian questions and options in urban affairs;
  - b) the value of pluralism in the support of investigations into relatively unexplored questions, so that there would not be a monolithic base for judgment of research proposals;
  - c) the case for placing some research funds in the hands of others than those with day-to-day administrative responsibilities, for in an expanding field they can rarely stay at the leading edge of knowledge, whatever their mandate and intentions;
  - d) the uses of a non-governmental body in identifying talents and leads and nurturing them to the point where they merit official recognition; (this has been amply demonstrated in the staffing of the Ministry of State for Urban Affairs); and
  - e) the essential function of a current and comprehensive information network through which the growing community of



policy-makers and investigators can know of new documents released and new studies underway; (this function has been served for 10 years by our computerized REFERENCES, Urban Research Bulletin, Urban Forum and microfiche service, and indeed by the existence and daily operations of the Council itself).

The Council's Prospects:

4. Since the creation of the Ministry of State for Urban Affairs, that Ministry has been the principal sponsor of the Council. We have changed our own constitution so as to enlist the fees and subscriptions of hundreds of individuals and groups and these revenues help meet the costs of the information network that cannot provide funds for significant research. We were therefore dismayed, upon requesting further funding from the Ministry, to be advised some months ago that it would phase out its support for the Canadian Council on Urban and Regional Research. This decision was taken well before the announcement by the Minister of Finance of restricted federal spending; it appears to have been taken by the Ministry without their having ready any alternative mechanism to mobilize Canadian urban research talent or to provide for continuation and development of the information network for which we have laid the foundations, always in the hope that these services would find a public host. If there were a strong federal-provincial system for these purposes in being, it might be said that our Council has served its purpose and should withdraw; but there is not. Although many provinces spend money on urban inquiries (and our Council was the first to tabulate the amounts), their common refusal to disclose the results is the opposite of "scientific." In our view the Ministry of State has abdicated in regard to one of the declared purposes for which it was created.

Events Contrary to Committee Recommendations:

5. Since you are inquiring about progress made in the implementation of your recommendations, we emphasize the contradiction between the above experience in Canadian urban studies and certain numbered recommendations in your Report, Volume 2, namely:
- 3 & 4) as to assessment of output and inventory of R & D projects;
  - 6) as to development of university research capacity;
  - 13) as to improved peer system to evaluate proposals;
  - 15) as to concentration on studies relevant to Canada;
  - 16) as to priority in the 1970s for basic studies in social sciences;
  - 40-43) as to scientific and technical information transfer for systems.

Contrary to the spirit of each of these recommendations, the present outlook for urban research in Canada is in our view poorer than it was when you made them.

Recommendations to Senate Committee:

6. In late 1975, the Canadian Council on Urban and Regional Research (given the events of the past two years in our field) has no choice but to make the following recommendations:
- (1) That the Senate Special Committee make publicly evident the responsibility of those in authority to build immediately upon existing experience and networks of communication in Canadian urban knowledge and practice;
  - (2) That your Committee urge at once (by interim report if appropriate) that the one institution of accomplishment in this field be maintained by the Ministry until it is certain that its level of attention and activity on these issues can be maintained by other means; and

- (3) In particular, that official action be taken to avert the dismantling of the scientific and technological information system kept in being by the Council (in Urban & Regional REFERENCES and the Urban Forum) until the same service is otherwise available to Canadians through other channels.
7. In putting forward these proposals, the Canadian Council on Urban and Regional Research is not arguing for its maintenance into the indefinite future, but rather is stating the case for the maintenance and gain in momentum of policy implementation by proven means, until such time as better means become available.

All of which is respectfully submitted,

Meyer Brownstone, President,  
Canadian Council on Urban &  
Regional Research

Appendix "49"

Le Conseil Canadien de Recherche en Sciences Sociales

Social Science Research Council of Canada

THE CONTINUING NEGLECT OF  
THE SOCIAL SCIENCES  
DEPLORED

A Brief  
Submitted by  
The Social Science Research Council of Canada  
to  
The Senate Special Committee on Science Policy

March 4, 1976



BRIEF SUBMITTED TO THE SENATE SPECIAL COMMITTEE ON SCIENCE POLICY  
BY THE SOCIAL SCIENCE RESEARCH COUNCIL OF CANADA, MARCH 4, 1976

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- H. The Social Sciences and Science Policy - The Response of the Social Science Research Council of Canada to A Science Policy for Canada, Vol. 2.
- I. Social Science Organization and Government: Response of the SSRCC's Committee on Policy and Finance to A Science Policy for Canada, Vol. 3.
- J. Brief Submitted to the AUCC Commission to Study the Rationalization of University Research, by the Policy and Finance Committee of the SSRCC.
- K. Social Science Research Policy and the Universities - A Commentary by the SSRCC on Quest for the Optimum: Research Policy in the Universities of Canada, by L.-P. Bonneau and J.A. Corry.
- L. Brief Submitted by the SSRCC to the Commission on Canadian Studies.

BRIEF SUBMITTED TO  
THE SENATE SPECIAL COMMITTEE ON SCIENCE POLICY  
BY THE SOCIAL SCIENCE RESEARCH COUNCIL OF CANADA

MARCH 4, 1976

A. INTRODUCTION

1. The SSRCC welcomes the continued concern of the Senate Special Committee on Science Policy with the issues raised in its report and the subsequent developments in science policy in Canada. A product of the optimistic, expansive sixties, the Committee's Report did not anticipate the severe retrenchment which science policy and scientific expenditures would suffer in the seventies, at least so far and for the foreseeable future.
2. In the light of these developments, the Committee's recommendations on priorities in the science and technology fields become even more pertinent and urgent. Obviously, the implementation of these priorities will now require harder decisions than were anticipated in the Committee's report.
3. In this short brief, the Council will confine itself to the second area of the Committee's intended "watchdog role," that of "a systematic review of the recommendations contained in the Committee's report on science policy." Only a few recommendations of most immediate concern to the Council will be commented upon.
4. The Council considers the other two terms of reference of the Committee also of importance but is unable to comment in detail at this time. A few comments on some relevant recommendations, however, do touch upon these issues.
5. The Council's main concern is with the fact that there is no evidence of any action to correct the serious neglect of the social sciences noted by the Committee in its Report, in spite of its forceful recommendations of emergency action to achieve rapid progress in redressing this imbalance.

## B. RECOMMENDATION 16

6. "at least during the 1970's the order of priority in government support for curiosity-oriented basic research should be, first, the social sciences and the humanities, and second, the life sciences, mainly those related to human health, provided of course that international standards of excellence can be developed and achieved in these areas."
7. This recommendation was based on a review of evidence which should be repeated here:

"The poor conditions of the social sciences in Canada have been deplored on several occasions, more consistently than any other part of the Canadian R&D effort. They have been emphasized by the Massey Commission, the Glassco Commission, the Bladen Report on Financing Higher Education in Canada published in 1957, the Science Council, the Economic Council, and the Macdonald report on The Role of the Federal Government in Support of Research in Canadian Universities. Similar views were expressed by many groups that appeared before the Committee, including the National Research Council. The neglect has been particularly evident in the sector of basic research, which is just the reverse of the situation in the physical sciences (Vol. 2, p. 458)."
8. The Committee suggested that "the situation of the social sciences and humanities should be treated as an emergency," at least for the 1970s, in order to achieve "rapid progress" (p. 461). This was necessary, it maintained, for both "curiosity-oriented" and "mission-oriented" basic research (pp. 461-465).
9. Since the publication of the Senate Committee Report, reasonably good statistics on federal scientific activities have become available in publications of the findings of an annual survey of federal departments and agencies carried out by Statistics Canada. In order to determine what has happened to this recommendation of the Committee, we can examine the trend of federal expenditures based on the five-year period, 1971-1976.\* See Table 1, pp. 6-7, for a summary of the relevant statistics.
10. Human science scientific activities have received a modestly increased share of the federal science dollar, from 17.9 per cent in 1971-72 to 23.2 per cent in 1975-76.

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\* The sources of the following data are: "Federal government expenditures in the natural and human sciences, 1973-74 to 1975-76." Report No. 100 of the Research and Information Services of the Ministry of State for Science and Technology; and Federal Scientific Resources, 1972 to 1974, Natural and Human Sciences, Ministry of State for Science and Technology, December 1973. Both reports utilized the Statistics Canada survey data. Figures for 1976 do not reflect budget cuts imposed after June 1, 1975.

11. Human science research and development has also received a larger share of the federal research and development dollar, from 7.7 per cent in 1971-72 to 12.1 per cent in 1975-76. Moreover, a larger proportion of the federal human science dollar has been allocated to research and development, up from 27.8 per cent in 1971-72 to 34.0 per cent in 1975-76.
12. Although the proportion of the federal research and development dollar going to extramural performers has declined (from 44.7 per cent in 1971-72 to 44.1 per cent in 1975-76), the share of the human sciences in the extramural research and development dollar has increased from 8.3 per cent in 1971-72 to 14.8 per cent in 1975-76. Also, a larger proportion of the human science research and development dollar went to extramural research and development, up from 47.9 per cent in 1971-72 to 54.0 per cent in 1975-76.
13. These modest improvements can hardly be described as a "reversal of priorities" reflecting "emergency action" to achieve "rapid progress." In fact, these slight increases do not even reflect an adequate response to increased participation in research and development on the part of social scientists, let alone correcting the deplorable situation existing at the beginning of the period.
14. That this is the case is more clearly evident when we turn to the universities as performers and the Canada Council as a supplier of funds for human science research and development.
15. Human science research and development performed by universities for the federal government has declined from 51.4 per cent of the federal extramural R&D dollar in 1971-72 to 34.7 per cent in 1975-76. It has also declined as a proportion of the federal human science R&D dollar from 24.7 per cent in 1971-72 to 18.8 per cent in 1975-76. *Hence the universities have not maintained their relative role as performers of federal extramural R&D in the human sciences and have not benefitted from the slight improvements noted above.*
16. The same observations apply for the Canada Council. Its share of the human science R&D dollar has gone down from 12.3 per cent in 1971-72 to 10.4 per cent in 1975-76, and its share of the extramural R&D dollar in the human sciences has gone down from 25.7 per cent in 1971-72 to 19.2 per cent in 1975-76.



17. The Canada Council has always been the major source of research dollars for the universities and has rarely supported research outside the universities. The two trends noted in paragraphs 15 and 16 are therefore related, resulting in an even greater dependence of the universities on the Canada Council: in 1971-72 the Council supplied 50 per cent of the universities' share of federal research and development dollars; by 1975-76 this proportion was 55.3 per cent.
18. A comparison of the Canada Council with the other two granting councils shows that its relative position remained unchanged. At the end of the five-year period, Canada Council's share of the federal science dollar going to the three granting councils for extramural scientific activities was still exactly the same: 14.6 per cent.
19. However, the Canada Council's share of the extramural research and development dollars spent by the three councils increased somewhat from 5.9 per cent in 1971-72 to 7.9 per cent in 1975-76. In the light of paragraph 18, this was entirely the result of the Council increasing the proportion of the extramural scientific activities dollars allocated to research and development, up from 33.3 per cent in 1971-72 to 46.8 per cent in 1975-76.
20. If the Canada Council is the main supplier of funds for basic research in the humanities and social sciences and if the universities are the main performers of such research, *basic research in the humanities and social sciences is in an even worse condition in 1976 than it was in 1972 when the Senate Committee's recommendations were published.* If, in addition, the annual rate of inflation is taken into account, *the modest overall gains did not even maintain levels of support and the Canada Council and the universities, and hence the community of humanities and social science scholars, have lost more ground relative to other suppliers and performers in the human science field.*
21. In the light of these general conclusions, the fact that the federal government imposed a freeze of the 1976 level of funding for the humanities and social sciences as part of the effort to reduce federal expenditures becomes even more alarming. A situation that has been lamented for decades and to which the Senate Committee drew attention five years ago as requiring emergency action, has not only been allowed to deteriorate even further, but has now been made subject to a substantial cutback.

22. If the social sciences are to contribute fundamental knowledge of the conditions underlying the major social problems and challenges faced by contemporary Canadian society, this deprivation must be reversed by concerted action on the part of the federal government. A government that believes that Canada needs a "new society," that major changes must be achieved in values, attitudes and institutions in a relatively short period of time, can ill afford to neglect the social sciences and humanities any longer. Only fundamental knowledge of Canadian society and culture will enable us to determine whether these changes are indeed required and, if so, under which conditions they can be achieved.
23. *The Council urges the Senate Special Committee to seek the immediate removal of the freeze on research grants to universities, at least for the social sciences and humanities, and to make strong representations to Cabinet that its earlier recommendation with respect to the urgent priority which should be given to fundamental research in the social sciences and humanities be implemented in government science policy.*
24. The Council recognizes that spending cuts are necessary in all areas. But it firmly believes that these cuts should be effected where they would hurt the people and the community least, that they should be and should be seen to be equitable and fair. Without commenting here on other aspects of the federal spending cuts, the Council considers the freezing of research grants in the social sciences and humanities as unfair and indefensible, given the "poor condition" of these fields in Canada, so universally deplored.

TABLE I

## A DETAILED COMPARISON OF FEDERAL HUMAN SCIENCE ACTIVITIES, 1972-76

PARA. #		1971-72		1975-76	
		Per Cent	\$'000	Per Cent	\$'000
	A. Total federal budget for Scientific Activities		1041.6		1528.1
	B. Human Science Scientific Activities		186.9		354.0
10	B as percentage of A	17.9		23.2	
	C. Total federal budget for Research and Development		672.5		997.6
	D. Human Science Research and Development		51.9		120.5
11	D as percentage of C	7.7		12.1	
11	D as percentage of B	27.8		34.0	
	C as percentage of A	64.6		65.3	
	E. Total federal budget for extramural R&D		300.9		439.7
	F. Human Science extramural R&D		24.9		65.1
12	F as percentage of D	47.9		54.0	
12	F as percentage of C	8.3		14.8	
12	E as percentage of C	44.7		44.1	
	G. Human Science R&D performed by universities		12.8		22.6
15	G as percentage of F	51.4		34.7	
15	G as percentage of D	24.7		18.8	
	H. Canada Council R&D (extra-mural)		6.4		12.5
16	H as percentage of D	12.3		10.4	
16	H as percentage of F	25.7		19.2	
17	H as percentage of G	50.0		55.3	

Continued...

TABLE I (Continued)

PARA. #		1971-72		1975-76	
		Per Cent	\$'000	Per Cent	\$'000
	I. Extramural R&D funded by:				
	NRC		68.2		98.5
	MRC		33.8		46.9
	CC		6.4		12.5
	TOTAL		108.4		157.9
19	CC as percentage of total I.	5.9		7.9	
	I as percentage of C	16.1		15.8	
	I as percentage of E	36.0		35.9	
	J. Extramural Scientific Activities funded by:				
	NRC		76.8		108.3
	MRC		35.6		48.4
	CC		19.2		26.7
	TOTAL		131.6		183.4
18	CC as percentage of total J.	14.6		14.6	
	J as percentage of A	12.6		12.0	
19	I as percentage of J:				
	CC	33.3		46.8	
	MRC	94.9		96.9	
	NRC	88.8		91.0	
	TOTAL	82.4		86.1	
36	K. Intramural human science R&D		27.0		55.4
37	K as percentage of D	52.1		46.0	



## C. RECOMMENDATION 6

25. ".....a Canadian Research Board be set up, together with three foundations, to report to the Secretary of State and to be responsible mainly for the development of a capacity for and the support of curiosity-oriented basic research in universities and similar institutions."
26. The SSRCC has responded on the whole positively to the announcement of the federal government's intention to implement part of this recommendation in the proposed reorganization of the granting councils.\*
27. The reported postponement of the reorganization until more funds can be made available for university research is an unfortunate step. The Council finds it difficult to accept the argument that there is no money to implement this important and long overdue change in the federal granting structures. Surely no one would argue that funds should be diverted from research programmes to finance the possibly higher costs of the new granting council for the social sciences and humanities. But it is not clear that such an implication would be unavoidable.
28. More importantly, every year of postponement will now leave the professional social sciences and humanities community in limbo. The case for a council consisting predominantly of professionals is a strong one in any field of scientific endeavour. In fields so badly neglected and so much in need of professional guidance and direction in their growth as the social sciences and humanities, it is indispensable and an urgent necessity. These fields require immediate action to identify gaps, priorities in relation to Canadian conditions, and future directions of development in knowledge and manpower.
29. These problems cannot be solved simply by making more money available. In fact, it could be argued that the new council would be better off if it need not launch new programmes and fund new applications immediately. Perhaps the period of relative scarcity of money foreseen for the next couple of years will provide favourable conditions for gaining experience in priority setting and for developing and consolidating the new organization.
30. *We therefore recommend that the necessary resources be allocated to establish the new granting council for the social sciences and humanities without further delay, even if the reorganization of the National Research Council has to be postponed.*

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\* See "Recommendations of the Social Science Research Council of Canada on the Proposed Granting Council for the Social Sciences and Humanities, 1974" (Appendix A) and "The Legal Status and Independence of the Proposed Social Sciences and Humanities Research Council, 1974" (Appendix B).

## D. - RECOMMENDATIONS 9 AND 17

31. ".....approximately 10 per cent of the national R&D effort be devoted to basic research by 1980 and that an immediate start be made toward this target." (9)
32. ".....the Minister of State for Science and Technology undertake a detailed review of the basic research activities carried out by all government agencies to see if they are justified and, if so, to consider whether some of them could not be advantageously transferred to universities." (17)
33. To the knowledge of this Council, no effort has been made to implement these important recommendations. As a result, the opposite has happened: the universities have lost ground as performers of federal research and development.
34. Basic or fundamental research in the social sciences and humanities has been grossly neglected to such an extent that their application or the application of available knowledge to current social problems becomes an extremely hazardous undertaking, overshadowed only by a trial-and-error, non-knowledge based approach.
35. In the humanities and social sciences, the proportion of R&D funds directed to basic or fundamental research should be more than the 10 per cent recommended by the Committee if the neglect of basic research in the past is to be corrected and compensated for. This will enable the rapid development of fundamental knowledge of Canadian society to take place to remedy the serious underdevelopment of these fields in the face of greater demands for fundamental social knowledge.
36. It is unclear how much basic research is being done intramurally in the human sciences by government departments. But over the five-year period, federal expenditures on intramural R&D in the human sciences have more than doubled (105.2 per cent increase) whereas the universities' share has increased by only 76.6 per cent.
37. The results of this inhouse research (\$55.4 million in 1976) are seldom published. Its quality and usefulness are unknown quantities. A review such as the Committee recommended is long overdue. It is the Council's view that this research will not compare well with research done in universities, not even in terms of usefulness in application. *The Council would, therefore, recommend that the federal government freeze expenditures on inhouse research, rather than university research, at least until such a review could establish the relative merits of certain types of intramural research in the human sciences.*
38. The Council is well aware that much needs to be done to upgrade the quality of social science research in Canada, in the universities as well as in government and industry. But relatively speaking, the expertise in these fields is concentrated in the universities where the training of future researchers for government and industry also takes place.

## E. RECOMMENDATIONS 1, 2, 18 AND FUTURE RESEARCH

39. ".....the Economic Council should enlarge its activities and establish a special Committee on the Future, with broad terms of reference but looking more specifically at the years 2000 and 1985 and attempting to project various possible environments that could emerge from the extrapolation of identifiable Canadian trends within the international context."(1)
40. ".....the Senate sponsor a conference for the purpose of establishing a Commission on the Future whose responsibility would be to help as many private and public organizations as possible to forecast and build their future not only in isolation but together."(2)
41. ".....in the future most basic research activities of the Canadian government be concentrated in a national research academy, with three institutes for the physical sciences, the life sciences, and the social sciences, with the purpose of filling gaps in basic research, especially in the social sciences and the life sciences." (18)
42. The SSRCC recognizes the basic needs for much firmer, better coordinated knowledge of the current state of Canadian society and its antecedents, as well as for a comprehensive approach to its future. These two needs should be met by the same programme, however organized.
43. A firm knowledge of the current state and past patterns and trends is an indispensable condition for any forecasting or forward planning activity. The same systems are required in the maintenance of a data base on the past and projections of the trends into the future. The same skills and techniques are called for. The combination of the two activities in one programme is therefore logically, economically, and practically sound.
44. None of the current agencies referred to in the Report or in the terms of reference of the Senate Committee seem appropriate for this role. There is a gap at the national institutional level that cannot be filled by any of the existing institutions, nor by the academy recommended by the Committee (18).
45. In recent years, the Economic Council, the Science Council, Statistics Canada, as well as other agencies have made efforts to step into the void that exists with respect to both current and future knowledge of Canadian society. None of them is properly equipped to perform this role adequately.

46. The Institute for Research on Public Policy has recently been asked to examine the need for future studies, but it apparently does not see itself performing this role and, at present, does not seem equipped to do so.
47. It is the Council's opinion that the filling of this gap is an urgent national priority. But, like so many other initiatives at the national level in Canada, it will require a complex and pluralistic approach to its planning and establishment if it is to mobilize the scarce human resources in Canada effectively and successfully.
48. *The Council recommends that the Senate Special Committee embark on extensive consultations with researchers in universities, industry and government to determine the best national strategy towards the establishment of the necessary institutional structure to meet Canada's needs for sound knowledge of current trends and for alternative choices to undesirable futures implied in these trends. The Council offers to assist the Committee in consultations with social science researchers in this regard.*



## F. VOLUME III, RECOMMENDATION 12

49. ".....the Royal Society of Canada, with the assistance of a special grant from the Ministry of State for Science and Technology, assume the overall responsibility for developing and maintaining relations with foreign private scientific and engineering bodies, operating at the international [or national level], in close co-operation with the International Branch of the Ministry and the specialized scientific and engineering associations existing in Canada."
50. The SSRCC objected strongly to this recommendation in a letter to the Prime Minister dated December 20, 1973 (Appendix C). As in regard to Recommendation 17 below, *it is the view of the Council that representative roles can only be played by properly structured representative organizations such as the SSRCC and HRCC, with some appropriate form of comprehensive coordination for the scientific field as a whole where necessary.* The Royal Society is ill equipped to act as a representative of Canadian social scientists and humanists, nationally or internationally.

## G. VOLUME III, RECOMMENDATION 17 (1), (2), (3), (4).

51. ".....the Ministry of State for Science and Technology be mainly responsible for defining and coordinating the Canadian government's relations with private scientific and engineering societies, that the present activities carried out by NRC, the Canada Council, and similar agencies in the area of relations with such private bodies at the national and international level be phased out and that the funds allocated by these government agencies for this purpose be transferred to MOSST;(1)
52. ....the Ministry formally recognize the Royal Society of Canada and the Association of the Scientific, Engineering and Technological Community of Canada (SCITEC) as the two main spokesmen of the Canadian scientific and engineering community in the areas of science for policy and policy for science respectively;(2)
53. ....the new 'make-or-buy' policy be applied in these two areas by all government departments and agencies, especially by MOSST and the Science Council, and that studies they require on these two topics be contracted out whenever desirable to the Royal Society and SCITEC;(3)
54. ....the Ministry of State for Science and Technology make an adequate, annual, unconditional grant to these two national bodies -- the amount to be determined after consultation with them -- for the purpose of enabling them to maintain an efficient secretariat, to undertake a few studies on their own initiative, to hold periodic symposia, and to finance their publications."(4)
55. *The Social Science Research Council would strongly advise against these recommendations and has done so before. It is encouraging to note that none of these have been implemented and it is hoped that the Senate Committee will not attempt to resurrect them.*
56. The SSRCC does not recognize any other non-governmental scientific association as a spokesman on social science for policy or policy for social science. Neither The Royal Society nor SCITEC, of which SSRCC is a member, is equipped to fulfill this role; nor does SCITEC currently aspire to this role.

56. Continued....

The SSRCC, on the other hand, has demonstrated repeatedly that it has the capacity and is recognized, to act as spokesman of the Canadian social science community in *both* respects.\*

57. Consequently, *it is the view of the Council that recommendations 17(3) and 17(4) should be implemented with respect to itself, the HRCC and other umbrella organizations in other scientific fields.* In cases where cooperation and coordination among these fields are required, SCITEC may be able to provide the necessary channels.

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\* See "National Social Science Conference on Social Science and Public Policy in Canada, Programme, 1975," and Social Sciences in Canada, Vol. 4, #1, Special Issue, 1976 (Appendix D); Canadian Public Land Use in Perspective, 1974 (Appendix E); Problems of Social Science Research at Smaller Canadian Universities, 1975 (Appendix F); "Final Report of the Enquiry into the Support of Scholarly Publication by the Social Science Research Council of Canada and the Humanities Research Council of Canada, 1975" (Appendix G); "The Social Sciences and Science Policy - The Response of the Social Science Research Council of Canada to A Science Policy for Canada, Report of the Senate Special Committee on Science Policy, Volume 2: Targets and Strategies for the Seventies, 1972" (Appendix H); "Social Science Organization and Government: Response of the SSRCC's Committee on Policy and Finance to A Science Policy for Canada, Vol. 3: "A Government Organization for the Seventies, 1974" (Appendix I); "Brief Submitted to the AUCC Commission to Study the Rationalization of University Research, by the Policy and Finance Committee of the Social Science Research Council of Canada, 1972" (Appendix J); "Social Science Research Policy and the Universities - A Commentary by the Social Science Research Council of Canada on Quest for the Optimum: Research Policy in the Universities of Canada, The Report of a Commission to Study the Rationalization of University Research, by L.-P. Bonneau and J.A. Corry, Ottawa, AUCC, 1972" (Appendix K); "Brief Submitted by the Social Science Research Council of Canada to the Commission on Canadian Studies, 1973" (Appendix L).

# Le Conseil Canadien de Recherche en Sciences Sociales

## Social Science Research Council of Canada

### STATEMENT ON THE CRISIS IN SOCIAL SCIENCE RESEARCH FUNDING

approved by Council, June 6, 1976

Mounting disquiet and concern among social scientists about the federal government's freeze on university research funding in the social sciences were expressed at the annual meetings of the Social Science Research Council of Canada and its member associations which concluded last weekend at Université Laval. The Council, which represents the ten major social science disciplines and over 10,000 social scientists in Canada, fears the serious effects of a continued freeze or too limited increases in research funding in the coming year, and calls upon the federal government to take immediate steps to correct the situation.

The foundation for the development of a strong Canadian research effort in the social sciences has been laid only in the last fifteen years. The current federal freeze on funds for universities comes at a time when Canada is only beginning to produce its own social science researchers in significant numbers and when they are developing major research programmes on important aspects of Canadian society. This foundation and the fundamental research being built on it are now in serious jeopardy as a result of the freeze.

Five years ago the Senate Special Committee on Science Policy reported that fundamental research in the social sciences had been seriously neglected in Canada. It called for an immediate reversal of priorities and emergency action to achieve rapid progress in the social sciences. Yet, in 1976, even before the freeze took effect, researchers in the social sciences were still worse off than those in the medical and natural sciences, who were also worse off than in 1969. The freeze aggravated an already desperate situation in social science research at a critical time when the potential for the development of Canadian social science knowledge and expertise is greater than ever before.

While the consequences of the freeze have appeared less obvious and dramatic in the social sciences than in the natural and medical sciences, they are no less serious. Indeed, they are more so since the social sciences are underdeveloped in Canada and more vulnerable at this stage of their development. It cannot be claimed that research teams built up over the years will have to be dismantled, because there still are virtually none in the social sciences. It cannot be claimed that equipment will become out-dated because the libraries on which social scientists rely, can hardly become less adequate and more out-dated than they are.



This demoralization of its social science community is a price Canada cannot afford since social science research on Canadian society and its major problems provides the fundamental self-knowledge without which sound social policies cannot be developed. With the challenges facing Canada and the world over the next quarter century and more, a strong social science research community and knowledge base have become critically important resources to society. Yet our existing knowledge of Canadian society is weak and the resources allocated for its development, already seriously deficient by all accounts, are now strained to the limit by the freeze.

Canada has many unique features which can only be understood through fundamental research on them. Questions relating to bilingualism and multiculturalism, the socio-economic implications of our transportation and energy requirements, the implications of the directions and rate of urban and population growth for education, health services and other institutions; the development of the North; the self-determination of the native peoples; the decentralization of government and the reduction of regional disparities -- all these problems cannot be attacked without the application of fundamental social scientific knowledge.

Some have suggested that Canada has a branch-plant economy and can rely on branch-plant science for its needs. It is doubtful that this suggestion can be accepted even in the natural and medical sciences where knowledge is in principle transferable. In the social sciences it is a dangerous idea and completely unacceptable. While molecules behave the same way in Moscow and Moose Jaw, people do not. The social science knowledge Canada needs cannot be imported if Canada is not to become a branch-plant society and culture without integrity and identity. Social science knowledge for Canadian society cannot be knowledge of some other society, because that would almost certainly impose foreign models on Canada and constitute acceptance of intellectual imperialism. Social science research must provide self-knowledge to a society, including self-criticism and knowledge for self-development. Without such knowledge a society remains a slave of tradition and a victim of circumstance, unable to choose its own destiny.

The development of such self-knowledge requires a national effort of considerable proportions to which the social sciences can make a major contribution. Independent research carried out by social scientists in universities is an essential component of such an effort, through which critical self-examination in relation to changing circumstances can be maintained. In Canada this effort remains partial and piecemeal, as the Symons Report, To Know Ourselves, shows. Such government research as there is, is oriented mainly to immediate, pressing problems of interest to governments, while the long-range requirements of society are neglected or ignored.

This situation cannot be permitted to continue. The Council recognizes that the current economic situation in Canada and the world called for special measures. But it should not be forgotten that it is largely the

result of our failure to understand adequately the forces that shape our economic activities, forces now recognized to be social and cultural rather than economic. Instead of a cut-back in efforts at self-knowledge, this situation calls for increased research to meet an unusual challenge and emergency. It calls for free inquiry into fundamental aspects of our society and unrestricted publication of findings for public consumption.

Universities, not government departments, are the institutions in which these conditions prevail. Yet the federal government spends four times as much on in-house research and development as on university-based research and development in the social sciences. The findings of in-house research seldom become public knowledge and hence contribute little to the self-knowledge of Canadian society. Instead, this type of research serves government purposes and, if not made public, undermines citizen participation in the discussion and formation of policies. Furthermore, it has been shown that applied research can only be useful if fundamental knowledge is available and is used in the application to the problems under investigation. It is therefore much more important to support fundamental independent research than in-house government directed research.

For these reasons the SSRCC strongly urges the federal government:

- a) immediately to increase the funds allocated to Canada Council for the social sciences and humanities to compensate for the freeze and, in 1977-78, to increase substantially the funds allocated for this purpose to enable the social sciences to catch up and to develop fully the potential they now have;
- b) to give priority to the funding of independent university-based research by diverting funds from in-house research in this direction to build social science research teams and resources in the universities so that public self-knowledge of Canadian society can be rapidly improved;
- c) to establish, without further delay, the proposed new granting council for the social sciences and humanities, with full autonomy to support independent research and to develop these disciplines;
- d) to develop a long-term policy for the sustained support of social science research as a high priority, not subject to indiscriminate cuts and across-the-board measures of constraint, in order to redress the current deplorable imbalance in research support with its dangerous consequences for Canadian society.

## Appendix "50"

## Le Conseil Canadien de Recherches sur les Humanités

## Humanities Research Council of Canada

March 4, 1976.

The Honourable Maurice Lamontagne,  
Chairman,  
Senate Special Committee on Science Policy,  
The Senate,  
Ottawa, Ontario.

Dear Senator Lamontagne:

I am writing to you on behalf of Professor Pierre Savard, Chairman of the Humanities Research Council of Canada (HRCC), in order to endorse certain of the recommendations which have been made to you by the Social Science Research Council of Canada (SSRCC). These recommendations are contained in a Brief which has been submitted to the Special Committee by SSRCC. A copy is attached to this letter.

The HRCC is pleased that the Special Committee has become active again and, in particular, is making "a systematic review" of the recommendations contained in its report on science policy.

The HRCC's main concern is with the fact that there is no evidence of any action being taken to relieve the serious neglect of the social sciences and the humanities noted by the Committee in its report. Even though the Committee suggested that "the situation of the social sciences and humanities should be treated as an emergency" (p461) there has been no response on the part of the federal government to achieve the "rapid progress" (p461) which was recommended.

Consequently, the HRCC agrees with the SSRCC and

urges the Senate Special Committee to seek the immediate removal of the freeze on research grants to universities, at least for the social sciences and the humanities and to make strong recommendations to Cabinet that its earlier recommendation with respect to the urgent priority which should be given to fundamental research in the social sciences and humanities be implemented in government science policy.

Hon. M. Lamontagne, March 4, 1976

Together with the SSRCC, HRCC has strongly endorsed the proposed reorganization of the federal granting councils insofar as it would affect the Canada Council. We share the view, expressed by SSRCC in the attached Brief, that the postponement of these organizational changes can only accentuate the neglect which the humanities and social sciences have experienced and which was so clearly underlined in the Committee's Report.

The HRCC therefore recommends

that the necessary resources be allocated to establish the proposed granting council for the social sciences and humanities without further delay.

The HRCC is already on record as disagreeing strongly with Recommendation 12 which proposed a new representative role for the Royal Society of Canada. It is the view of the HRCC that representative roles can only be played by properly structured representative organizations such as SSRCC and HRCC. The Royal Society is ill-equipped to act as a representative of Canadian social scientists and humanists nationally or internationally.

Similarly with respect to Recommendations 17 (1), (2), (3) and (4), the HRCC would emphasize, so far as the humanities are concerned, the inappropriateness of the roles proposed for the Royal Society and the Ministry of State for Science and Technology. The HRCC does not recognize any other non-governmental scholarly association as a spokesman for the humanities community in Canada.

We would therefore urge that Recommendations 17 (1) and (2) not be acted upon so far as they include the humanities. With reference to Recommendations 17 (3) and (4), we would suggest that they be implemented with respect to HRCC, SSRCC and other umbrella organizations in other scientific fields.

In conclusion therefore, we recommend that:

- a) immediate attention be given to ensuring that "curiosity-oriented basic research" in the humanities and social sciences be a first priority for federal government support;
- b) the budgetary freeze on funding for university research, especially in the humanities and social sciences, be removed;




Hon. M. Lamontagne, March 4, 1976

c) the necessary resources be allocated to establish the proposed granting council for the humanities and social sciences without further delay; and

d) the representative nature of the HRCC and SSRCC be appropriately recognized by the federal government and that for the fields of the social sciences and the humanities no other umbrella organizations be so recognized.

Finally, I would like to indicate the appreciation of the Council for providing this opportunity for the expression of our views.

Yours sincerely,



John Banks,  
Executive Secretary.

JB:dd



FIRST SESSION—THIRTIETH PARLIAMENT

1974-75-76

THE SENATE OF CANADA  
PROCEEDINGS OF THE  
SPECIAL COMMITTEE OF THE SENATE ON  
**SCIENCE POLICY**

The Honourable MAURICE LAMONTAGNE, P.C., *Chairman*

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Issue No. 26

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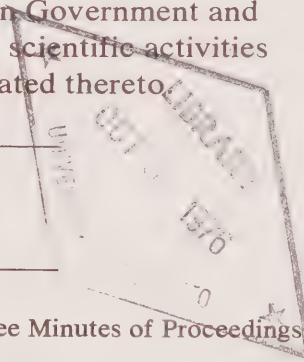
THURSDAY, SEPTEMBER 9, 1976

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**Twenty-sixth Proceedings on:**  
the Study of Canadian Government and  
other expenditures on scientific activities  
and matters related thereto

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(Witnesses and appendices: See Minutes of Proceedings)



THE SPECIAL COMMITTEE OF THE  
SENATE ON SCIENCE POLICY

The Honourable Maurice Lamontagne, P.C., *Chairman*

THE Honourable Donald Cameron, *Deputy Chairman*

AND

The Honourable Senators:

Asselin	Hastings
Bélisle	Hicks
Bell	Lang
Blois	Manning
Bonnell	Neiman
Bourget	Riel
Buckwold	Robichaud
Carter	Rowe
Giguère	Stanbury
Godfrey	Thompson
Goldenberg	van Roggen
Grosart	Yuzyk
Haig	

27 Members

(Quorum 5)

# Order of Reference

Extract from the First Report of the Special Committee of the Senate on Science Policy, presented on July 10, 1975 and printed as an Appendix to the Minutes of the Proceedings of the Senate of that day, and adopted by the Senate on July 24, 1975:

"The Committee, therefore, recommend that it be authorized to consider and report on Canadian government and other expenditures on scientific activities and matters related thereto;

That the Committee have power to engage the services of such counsel and clerical personnel as may be necessary for the purpose of the inquiry;

That the Committee have power to send for persons, papers and records, to sit during adjournments of the Senate and to report from time to time; and

That the Committee be authorized to print such papers and evidence from day to day as may be ordered by the Committee."

Robert Fortier,  
*Clerk of the Senate.*



# Minutes of Proceedings

Thursday, September 9, 1976.  
(40)

Pursuant to adjournment and notice the Special Committee of the Senate on Science Policy met this day at 2:37 p.m., the Chairman, the Honourable Senator Lamontagne, presiding.

*Present:* The Honourable Senators Bell, Carter, Godfrey, Hicks, Lamontagne, Lang and Yuzyk. (7)

*In attendance:* Mr. Philip J. Pocock, Director of Research and Mr. Jacques W. Ostiguy, Chief of Administration.

The Committee resumed consideration of its Order of Reference dated July 24, 1975 relating to the study of Canadian Government and other expenditures on scientific activities and matters related thereto.

The following witnesses were heard:

*From: The Electronic Sector of Electrical and Electronic Manufacturers Association of Canada:*

Honourable Léon Balcer, Executive Vice-President, Electrical and Electronic Manufacturers' Association of Canada;

Mr. H. Lloyd Webster, Director of, and Chairman, Research and Development Committee, Electrical and Electronic Manufacturers Association of Canada; and Vice-President, and Product Line Manager, Switching Systems and Transmission, Northern Telecom Limited;

Mr. Keith Rapsey, Director and former Chairman of Allen-Bradley Limited; and Former Chairman, Canadian Manufacturers Association;

Mr. Ken D. Mills, Former Chairman, Research and Development Committee, Electronic Industries Association of Canada; Chairman, Electronics Research and Development Committee, Electrical and Electronic Manufacturers' Association of Canada; and Manager Engineering, Electronic Systems Division, Westinghouse Canada Limited;

Mr. I. A. Mayson, Vice-Chairman, Electronic Systems Division, Electrical and Electronic Manufacturers' Association of Canada; and Vice-President and General Manager, Government and Commercial Systems Division, RCA Limited;

Dr. T. W. R. East, Director of Advanced Development, Raytheon Canada Limited;

Dr. F. J. F. Osborne, Director, Communications and Space Technology Laboratory, RCA Limited;

*From: Air Industries Association of Canada:*

Mr. David Mundy, President;

Mr. J. D. MacNaughton, Vice-Chairman of Air Industries Association and Vice-President SPAR Aerospace Product;

Mr. K. F. Gibson, Chairman of AIAC Avionex Committee and General Manager of Leigh Instruments Ltd.;

Mr. Sidney Young, Chairman of AIAC Research and Development Committee and Chief Engineer of Douglas Aircraft of Canada Ltd.

On Motion duly put it was *Agreed* that the briefs presented by the Electronic Sector of the Electrical and Electronic Manufacturers Association of Canada and the letter dated December 9, 1975 addressed to Senator Maurice Lamontagne from Air Industries Association of Canada be printed as appendices to this day's Minutes of Proceedings and Evidence. (*See Appendices Nos. "51" and "52"*).

The Honourable Balcer, Mr. Mills and Mr. Mundy each made an opening statement. The witnesses then answered questions put to them by Members of the Committee.

At 5.17 p.m., the Committee adjourned to the call of the Chairman.

ATTEST:

Patrick Savoie,  
*Clerk of the Committee.*

# The Special Committee of the Senate on Science Policy

## Evidence

Ottawa, Thursday, September 9, 1976

The Special Committee of the Senate on Science Policy met this day at 2.37 p.m. to consider Canadian government and other expenditures on scientific activities and matters relating thereto.

**Senator Maurice Lamontagne (Chairman)** in the Chair.

**The Chairman:** Honourable senators, we are very happy, of course, to have with us today representatives of the Electronics Industries Association of Canada and the Air Industries Association of Canada. I do not think I should make individual introductions. We have already received representation from the Chamber of Commerce and the CMA, and we have had a number of meetings with the engineers. We understand that you gentlemen are big employers of engineers, and they have had their say before this committee. We think, however, that you have a particular message to give us. As you already know, we have recommended in the past that industry should participate much more in the national research and development effort, leading to innovations. We still think that this is a very important aspect of overall Canadian policy, and we are anxious to hear what you have to say this afternoon.

Before we proceed further, I would like a member of the committee to move that the two briefs which have been distributed to us should be printed today as appendices to today's proceedings.

**Hon. senators:** Agreed.

*(For text of briefs see Appendices 51 and 52, pages 25 to 30)*

**The Chairman:** As to the order of precedence, I believe you, Mr. Mundy, were formerly an assistant deputy minister, but we have a former minister here today.

**The Honourable Leon Balcer (P.C., Q.C. President, Electronics Industries Association of Canada):** Mr. Chairman, that reminds me of a member of Parliament who approached Mr. St. Laurent and said, "Mr. Prime Minister, I would like to be made a minister. I have been a good member," and so on. Mr. St. Laurent replied, "I am very sorry, but you are not really qualified for that." The member of Parliament said, "Look, sir, I am not asking to be a deputy minister. All I want to be is a minister."

**The Chairman:** I heard that story before, but it was attributed to Mr. Mackenzie King.

We will therefore hear from Mr. Balcer, who will introduce his delegation at the same time.

**Hon. Mr. Balcer:** Thank you very much. Mr. Chairman and honourable senators, as you know, the Electronics Industries Association presented a brief last March on your report, and since last March our association has

joined in a merger with the Electrical Manufacturers' Association.

**The Chairman:** That is a new story. We still deplore here the pluralistic approach of all the organizations, and it is nice to hear of a merger.

**Hon. Mr. Balcer:** We had to face big government, so we wanted to be big, too.

This afternoon Mr. Ken Mills will be making our presentation, but he will be speaking also for the electronics sector of our association, because his remarks will be based on the short brief that we presented last March.

Also among our group is Mr. Lloyd Webster, Chairman and Director of the Research and Development Committee of our association. Mr. Webster is Vice-President and Product Line Manager, Switching Systems and Transmission, Northerntelecom Limited.

We have with us also Mr. Keith Rapsey, Director and former Chairman of Allen-Bradley Limited. Most of you know of him, or know him personally, because he was a former Chairman of the Canadian Manufacturers' Association, and has appeared before many committees. He is also a member of the electrical sector of our association.

Mr. Ken Mills, who will make the presentation, is a former Chairman of the Research and Development Committee. He is also manager of the Engineering and Electronics Systems Division, Westinghouse Canada Limited.

Mr. I. A. Mayson is Vice-Chairman of the Electronics Systems Division of our association, and is also Vice-President and General Manager of the Government and Commercial Systems Division of RCA Limited.

Mr. Fred M. Hanna is a member of the Research and Development Committee of our association, and manager of New Product Planning with Aviation Electric Limited. Dr. T. W. R. East is Director of Advanced Development with Raytheon Canada Limited. Dr. F. J. F. Osborne is Director of the Communications and Space Technology Laboratory, RCA Limited. Mr. T. M. Mimee is manager of Government Relations with our association.

I will now give my seat up to Mr. Ken Mills.

**The Chairman:** I hope, however, that during the question period you will not be reluctant to answer any questions that might come from the members of the committee.

**Hon. Mr. Balcer:** I will be available.

**The Chairman:** Thank you.

**Mr. K. D. Mills, Chairman, Electronics Research and Development Committee, Electrical and Electronic Manufacturers' Association of Canada:** Mr. Chairman, I have a relatively few opening remarks to make. First of all, I would just like to touch on industry perspective by

saying that the electrical and electronic industry is one of the major and strategic industries in any industrialized country. Its products permeate all sectors of the economy and are important to all aspects of life, the household, business, industry and defence.

The industry as a whole is a mix. It is high growth, and high volume, labor intensive in some segments, capital intensive in other areas, and highly innovative, based on research and development. It employs a much larger proportion of scientists and engineers and technicians engaged in R&D work than any other private sector industry.

The wide range of products made by the industry include household appliances, power generation and distribution systems, telecommunications equipment, computer peripherals and measuring instruments. Due to the mix and range of products, a meaningful measure of productivity is difficult to define for the industry.

In 1975 the industry employed about 142,000 persons or 9.2 percent of all manufacturing employment, and produced about \$5.2 billion in goods of which about \$1.0 billion worth was exported. In the same year Canada had a trade deficit in electrical and electronic products which amounted to \$1.8 billion or 25.2 percent of the industry's domestic market.

Average annual growth rates for the industry in the past decade have been production 8.4 percent, exports 14.1 percent, and employment 0.1 percent. The domestic market, which in 1975 exceeded \$7.0 billion, has grown at an average rate of 9.6 percent a year. Imports are taking an increasing share of this market, rising at an annual average rate of 13.9 percent.

The foregoing summarizes the industry represented by the Electrical and Electronic Manufacturers' Association of Canada (EEMAC). EEMAC came into being in March 1976 when the Canadian Electrical Manufacturers' Association and the Electronic Industries Association of Canada combined as a single entity. The association consists of 230 member companies.

With regard to the electronics Sector, the invitations to submit a brief late last year and subsequently to appear before the Senate science policy committee were extended in the name of the Electronic Industries Association of Canada. Therefore, the views and comments in the brief submitted last March and in this statement reflect the electronic sector of EEMAC. The data used is based on information from Statistics Canada and other official sources and refers to both sectors unless otherwise stated. Every industrial country in the world recognizes the national importance of an electronic industry.

**Senator Godfrey:** Can you just define the difference between electrical and electronic for the record?

**Mr. Mills:** This will be made up as I go along. There is no standard definition.

**Senator Godfrey:** I thought you just assumed that everybody knew.

**Mr. Mills:** I am afraid not. It is a good question, as they say, when one has difficulty in answering it. "Electrical" conjures up in my mind the power distribution side of the business, the power generation equipment, for example, distribution through cities across the country. "Electronics" is typified by radio, radar, computers. It is sometimes referred to as light current, mechanical current, produc-

tion, as opposed to power engineering which tends towards the generation and heavy powered distribution. That may not be, or ever will be, a classic definition.

**Senator Godfrey:** Well, you have improved my knowledge.

**Mr. Mills:** In Canada the recognition by the federal government of the importance of the electronic industry is of a philosophical nature. It is not supported by concrete scientific and industrial R&D policies and actions. In fact Canada is at the bottom of a long list when measured by such factors as R&D as a percentage of GNP, imbalance of trade in high technology products, or the amount of R&D dollars spent by industry versus that spent by government.

Without a high technology industry such as electronics, Canada cannot maintain her position as one of the advanced nations of the world. The electronic industry more than any other industry is felt to fit the future projections of economists and sociologists for industries built on intellectual quality and know-how.

The quality and technological excellence of Canadian electronic products is well recognized. The potential is considerable. Opportunities exist in recapturing a larger portion of the domestic market, satisfying the general growth in domestic and worldwide demand and generating new markets by development of innovative products and application of electronics.

Canadian-built equipment and systems are widely accepted throughout the world in such areas as commercial and military communications equipment, navigational aids and computer peripherals. Exports of these products were valued at \$739 million in 1975, more than 30 percent of electronic sector shipments last year.

The electronic sector, as a high technology industry, is characterized by rapid and continual change caused by a high level of innovation and new product development. As should be expected it is Canadian industry's largest investor in R&D, accounting for more than one quarter of the total of Canadian industry.

The electrical and electronic industry as a whole has consistently been the largest performer of R&D since 1966, among eight industry groups. In 1972 it expended on intramural R&D \$110 million or 27 percent of all industry.

Preliminary 1976 data, in comparison with 1972, reflects an increase of about half or a total of \$163 million, and still representing 27 percent of all industry.

The inclusion of capital expenditures on R&D facilities and equipment, and extramural R&D expenditures, brings the 1976 projection for the electrical and electronic industry to about \$200 million and to about \$759 million by all Canadian companies. Comparative 1975 figures were \$182 million and \$706 million respectively.

In 1974, the industry's intramural R&D expenditures were 66 percent company financed and 13 percent federally financed.

**Electronic Industry Climate:** The electronic industry must contend with a multitude of factors and problems not faced in other countries. The problems of geography and population size and distribution are traditional examples. Recent examples are high labor rates, high cost of money, government regulation, and the predisposition of government towards free trade in the face of export trade barriers.



The industry recognizes that it has many problems of its own making and that it must face the tasks which right fully belong to it in improving its situation. But the factors which depend on government are so much more basic and pervasive that industry itself is hampered in improving its situation.

It is the government's responsibility to declare national goals, policies and priorities and to initiate actions to achieve the goals.

The electronic industry depends on innovation to be competitive. Many elements of the industry need to develop technological skills as a base for innovative and entrepreneurial R&D, but the industry must perceive an environment which encourages and supports industry investment in product R&D and the total innovative process.

The electronic sector agrees with government on the need to rationalize its R&D, production and sales to seize upon major domestic and export opportunities. But mergers and specializations specifically designed to achieve rationalization are hampered by federal competition laws.

Government action in curtailing R&D incentive programs for industrial research without having alternative programs ready, and the uncertainties introduced by AIB regulations have had an unsettling effect on the industry. We cannot afford government action which forces many of our smaller companies to cut back or cut out research.

Incentives for entrepreneurship, innovation and productive performance must take priority over more government and subsidies for non-performance. There must be improvement in the climate for the wealth producing sectors to cover the costs of the country's non-productive overhead.

Production which can evolve from expanded Canadian industrial research in all fields, can in time and with patience produce a climate to achieve the social, economic and cultural objectives of Canadians.

Recommendations of the electronic sector of EEMAC on federal government policy on science and industrial R&D are:

... Formulate a scientific and industrial research policy and implement it immediately. This policy must be a blueprint for genuine technological sovereignty consistent with international interdependence as advocated by the Science Council of Canada in its report number 24, December 1975. It must recognize that most modern industries are science based. It is fundamental to the exploitation of science to the benefit of all Canadians.

... Use incentives to stimulate R&D that leads to the innovative process, focusses on selected areas, creates new business, new employment and profit. These incentives, accompanied by simple implementing procedures, should include:

... fast tax write-offs for current and capital R&D expenditures without regard to previous levels of spending

... start-up grants for new ventures where no prior profit existed

... the continued use of unsolicited proposal funding which is a key element of the federal make or buy policy.

... Increase the amount of R&D contracted to industry by reducing government performed R&D. Industry can

best exploit R&D benefits that relate to high technology products. Because of limited funds for R&D in our economy, industrial labs not government labs should be developed as an R&D resource. We welcome the recently projected increase to about \$80 million under the make or buy program for industry participation in government sponsored research as a step in the right direction toward the majority of R&D being performed in industry.

**Conclusion:** The electronic industry has expressed views in recent years on such areas as tariffs, taxation, competition law, standards, patents, and government procurement. We believe they are matters in the national interest. We think that like R&D they are elements of an industrial or industry strategy. But we sometimes feel like astronauts must feel on space walks, a sense of aimless floating because of a lack of atmosphere.

That is not the feeling of the industry in relation to the Senate science policy committee. We have seen the results of your work and as outlined in our brief we support most of the recommendations contained in your report.

We look to the committee as a catalyst to accelerate the early formulation and implementation of a long-term federal science and industrial research policy, a policy which recognizes the need of all sectors of our society, incorporates major national goals and priorities, and ensures the further development of our country.

Thank you, Mr. Chairman.

**The Chairman:** Thank you very much. I am sure that all members of the committee will be happy with your last paragraph, although I am sure it will not make the headlines tomorrow.

**Mr. Mills:** No, there is too much competition.

**The Chairman:** Mr. Mundy, who is President of the Air Industries Association of Canada and who appeared before this committee previously in another capacity will now make his opening statement.

**Mr. David Mundy, President, Air Industries Association of Canada:** Thank you, Mr. Chairman. We are pleased indeed to have this opportunity of appearing before this committee, particularly because of the pre-eminent role that you have played in focusing public attention on science policy. I would like first of all to introduce the members of our team: John MacNaughton, Vice-Chairman of Air Industries Association and Vice-President of SPAR Aerospace Products; Ken Gibson, Chairman of our Avionex Committee and General Manager of Leigh Instruments Limited of Carleton Place, and Syd Young, Chairman of our R&D Committee and Chief Engineer of Douglas Aircraft of Canada Limited.

Mr. Chairman, I am the full-time president of the association and will make our opening statement, which is general and related to the overall competitive position of secondary industry in Canada, with particular reference to the government-industry interface. We feel that a full understanding of the current position in which Canadian industry finds itself is a necessary prelude to a discussion of science policy at this juncture in Canadian affairs.

Key economic indicators in Canada, such as labour rates, interest costs, per capita income, balance of trade, show that Canadian secondary industry is probably moving into a non-competitive position in the world.



It is well known that a future tied to exporting raw materials for a country such as Canada, which is running out of resources and which has a chronic unemployment problem, is a dead end. If we are to make our way in the world we have to look primarily to the manufacturing sector. We are not trying to suggest that we abandon the primary or the service sector. Far from it. Rather, we are saying that in looking at the coming economic crunch in Canada, we have to focus our attention for any major improvements on secondary industry. It is also well known that a large portion of the manufacturing sector is dependent upon the innovative process to flourish. We would define the innovative process as the successful completion of the product cycle of research, development, production, and marketing at a profit.

At each stage there is an overlay of entrepreneurial decision-taking and the successful outcome of the process is described as innovation.

It is recognized also that by international standards our R&D effort in Canada is poor. Gross Expenditures on R&D (GERD) as a percentage of GNP has declined from 1.29% in 1969 to 1.14% in 1972. This committee itself warned that the figure had to be more than twice that level, i.e., 2.5% of GNP, in order to maintain our international competitiveness. By your own standards, Mr. Chairman, Canada is obviously in serious trouble on this score. As the great majority of Canadian R&D is still performed in government, the comparison of industrial R&D in Canada with other countries is even worse.

Comparative data for 1971 show that industrial R&D in Canada was vastly out of line with other western countries. The total for all industry in the U.S. was 45 times Canada, for U.K., 4 times, and for Germany, 7 times our own. (In 1973 we have only comparative figures for the USA, but they still show the same adverse ratio—about 45 times our own). On a per capita basis the 1971 expenditures ratios compared to Canada were: United States, 4.6 times us; the United Kingdom, 1.5 times, and Germany, 2.5 times. That is 1971. We all know that Germany has had a vast increase in their national R&D effort, and I would guess that that figure is substantially higher at present.

If you look at it another way, government expenditures on R&D, expressed as a percentage of the federal budget, have been declining at twice the rate for the industry portion—we have these statistics for the years 1970-75—as compared with the decline in the in-house portion of such expenditures.

Having said all this there are, however, still substantial R&D programs continuing in Canadian industry, and the one which I represent, the aerospace industry, is eager to continue such programs where there is a pay-off. However, the environment in which we operate must be understood. I propose to identify the features of this environment and recommend some general lines of action.

• First of all, I would like to deal with the government/industry interface. Industry is increasingly involved with government, a trend that is evident around the world. Private enterprise, in the classical sense of an individual or company having an idea and going out and exploiting it on their own, is virtually over, and at every turn you require either the active or passive assistance of the government. Governments are now in almost every sphere—regulatory, international negotiations, export financing, incentive programs, environmental control, procurement—and the list goes on and on. This is not registered as a complaint

against this type of mixed economy approach, but rather to highlight the fact that successful operation of the private sector in Canada will depend upon improved methods of cooperation between the public and private sectors. This applies in particular to the R&D sphere, as well as all segments of business enterprise.

It is our view that government has not adapted itself organizationally to the problem of managing their intervention in the private sector. Or perhaps a less harsh word would be involvement, but we do not argue about that.

The potential for harm as well as help within the government in any major industrial enterprise is enormous. Any such project impinges upon the territory and the prerogatives of multiple departments of government. What is needed is improved methods of managing this interdepartmental intervention. By and large, government is organized so that different departments pursue their own courses with the cabinet being the sole authority to override or harmonize decision-taking. With the complexity of modern government, it is not possible for such a small group of men to take multiple and detailed decisions as they apply to major industry projects. Now, of course, any major policy decision of industry has to be dealt with at the cabinet level; we are not arguing that.

To reiterate, there is tremendous potential within government for both harm and good in the successful launching of new industrial product lines. The Defence Industrial Productivity program of the Department of Industry, Trade and Commerce is an example of a sophisticated and helpful interface between government and industry. The make-or-buy program, insofar as it has progressed to date, including the unsolicited proposal procedures and the bridging funds of the Department of Supply and Services, is another example of a helpful and smooth joint government/industry effort, where the basic initiatives come from industry but government acts in a helpful manner. However, there are not enough of these. Furthermore, the exploitation of the full potential of the government connection with industry requires either tremendous skill on the part of industry on how to use the system to their benefit, or exceptional dedication by key civil servants to harmonize interdepartmental effort to the benefit of Canadian policy objectives and Canadian industry.

This system is not good enough for the crisis facing Canadian secondary industry. We need to re-think our whole industrial strategy in terms of the development of new mechanisms for the government/industry interface. We think this should be done on an evolutionary basis, and we should start, sector by sector, no matter how small, on a combined government/industry strategy where the partners are on an equal basis and where, by dealing with real life cases, we can improve the machinery in both the public and private sector. Other countries have done it, but it has to be in line with the peculiarities of the national political, economic and social structure. We do not believe, despite the success of other countries, that some blueprint or some broad organizational manipulation will be successful. The problems are too diverse and too complex. But the essentials are clear. Industry and government on a sector by sector basis must get together to focus and direct the combined leverage of Canadian government and industry to pull this country up by its boot straps through the innovative process.

**The Chairman:** I cannot refrain from intervening at this stage. We had suggested exactly that kind of approach in 1972, the sector-by-sector approach, organizing task forces

on that basis. It was not accepted by the Department of Industry and it was very much resented by quite a number of industrial sectors.

**Mr. Mundy:** I can tell you one industrial sector it is not resented by, Mr. Chairman. I will come to this at a later stage when I will be glad to be asked questions on the issue. We believe that this has to be done, and I am pleased to be reminded that you took that position some time ago.

**The Chairman:** I could not refrain from interrupting. I am sorry.

**Mr. Mundy:** The next point I wish to raise is that the environment for Canadian industry is one of excessive dependence on exports. In many ways it is an uncomfortable position for us to be in, as individual companies and as a nation. But it is a fact of life. The aerospace industry, for example, exports 80% of its product.

Generally speaking, to design for the domestic market is economically unsound, and can waste millions of dollars. To be successful, industry has to obtain high volume sales for its products, and this means exports. Therefore, both government and industry, at all stages of the product cycle—research, development, production and marketing—must orient themselves towards exports. The domestic market can be a most useful adjunct, particularly during early stages of production to help get the product accepted, but it can not by itself provide the required volume, unless there were some fundamental changes in government procurement and trade policy. From the point of view of government planning, government incentive programs, foreign policy, trade policy, environmental controls, procurement, regulatory arrangements, and any other form of government intervention, we must accept the essential truth that we Canadians are increasingly dependent on the competitiveness of our products in export markets and on the goodwill of our foreign customers. It is essential, therefore, that we improve our ability to compete in world markets.

My third point concerns the focus of initiative for new product lines. If R&D in Canada is to be expanded in line with the national objectives of advancing technology, increasing employment and improving productivity, the place to start is within the private sector, and to search for product lines which suit the company concerned and which are saleable in export markets. Government planned R&D is not the answer. Nor is there any point in doing R&D for R&D's sake, or to please government officials. With certain exceptions, dealt with at a later stage, the private sector and not the public sector should be the prime mover for finding product lines and exploiting them. The role of the government is to provide the right environment and encouragement.

My fourth point concerns access to technology. Canada is not a large enough country in terms of financial and physical resources to make any major breakthroughs in base technology. There must be an access to this technology from outside the country, at least in the opening years of the establishment of a product line.

In the aerospace and electronic industry, the traditional pattern in our primary markets, which are the United States and Europe, is for the technology to come from and be paid for by the military. The military US connection is therefore vital. But the whole climate between the US and Canadian governments is a vital ingredient in our success in these markets. We must maintain the easy relationship

sponsored by the production sharing agreement between our countries. We must maintain the technology access through the industry route, through multinational—parent to subsidiary—or, in the case of Canadian-owned firms, technology agreements with foreign firms.

My fifth point has to do with specialization and scale of effort, and these are the obvious pay-off for Canadian secondary industry. This means choosing some relatively small corner of technology (i.e., in world terms), supporting it with the full resources of both government and industry, and exploiting it in world markets. There are multiple examples of where this has succeeded, such as Pratt & Whitney Aircraft of Canada Ltd. in small gas turbines, The de Havilland Aircraft of Canada Limited in STOL aircraft, Canadian Marconi Company in Doppler navigation, CAE Industries Ltd. in simulators, and Leigh Instruments Limited in data recorders and crash position indicators. The rise and maturing of innovative companies is a continuing process, and there are a number of other companies, such as SPAR Aerospace Products and SED Systems, which are in the growth cycle. There are also examples of failure, where usually a major contributing factor was the small scale of effort, combined with the rather hostile business environment in Canada.

Finally, I want to deal with long term planning. We do not believe that the government is inclined or, indeed, competent to develop a blueprint for the whole of Canadian industry. However, there are certain areas where the government is so obviously the prime mover and so all-powerful that there is a need for some better long term planning, the results of which should be indicated to those companies concerned. One such area is the field of space. Very large sums of money have been spent by Canadian government in one form or another over the past decade. Indications are that similar sums of money will be spent on space projects in the future. As noted in the report of the Space Committee of AIAC of January 1976, there is an absence of long-term planning and linkage of these government expenditures and efforts to industrial objectives.

I would now like to come to my concluding remarks, Mr. Chairman.

The foregoing has been rather heavily weighted towards identifying the environment in which industry operates. This seemed necessary for an understanding of some possible solutions to the serious problems facing the country over the next decade. Although we have no magic formula, we believe that the steps involved in tackling these problems include the following:

First and foremost, the people at the top—the Prime Minister and the cabinet—must recognize that the future of the country rests on solving the growing crisis in Canadian secondary industry. It is the key to the unemployment problem. Its performance is critical to our overall productivity levels. It is at the heart of our balance of payments problem.

It is the foundation on which our future, including social security programs, have to be built. The business community doesn't see any real evidence as yet that there is recognition in Ottawa of this essential fact. Once this is recognized, steps can be taken to improve the business environment. No matter how mixed our economy is, no matter how much government intervention there is, the foundations of our economy still rest in the private sector. The private sector has to be understood and motivated to achieve national goals.



For secondary industry to flourish in the environment described above:

We must solve the organizational problem between government and industry. Except for isolated instances, there is not smooth meshing and harmonizing of government and industry actions towards national objectives which is characteristic of most successful western countries. There should be a managed and sophisticated dialogue between government and industry on a sector by sector basis formulas or tremendous blueprints from government as to how we are to proceed, but we believe in an evolutionary process of tackling, on the micro scale, sector by sector or project by project, jointly with the government, the improvement of our industries' posture.

We must have an ongoing portfolio of major new, internationally oriented, innovative product lines. We must also concentrate our resources, both public and private, on specialized product areas and those with a high pay-off. Industry must take prime initiative in defining projects it believes can be tackled successfully. A central agency of government should have funds available to support quickly such projects where necessary.

Government must define R&D support and other incentives to innovation and ensure that a sufficiently stable policy is maintained so that long term product development commitments can be responsibly undertaken by industrial managers.

The political and economic climate must be such that production sharing arrangements and parent/subsidiary and technical cross-over relationships provide for the flow of appropriate technology to Canadian industry.

Secondary industry is the key to solving Canada's major economic problems and so improving the quality of life in this country. There is great potential, but it needs to be harnessed, and time is running out. The private sector should be performing better than it is, but government is equally at fault. Government and industry must both be seized by the urgency of the situation and take vigorous action to promote the steady development of internationally competitive product lines, thus ensuring that employment and export trade are at levels consistent with our national objectives.

**The Chairman:** Thank you very much, Mr. Mundy. We have had two excellent presentations, and the meeting is now open for discussion.

**Senator Godfrey:** I cannot help but compare the opening statements today with the briefs that were presented by the Canadian Chamber of Commerce and by the Canadian Manufacturers' Association, in one area particularly. At page 6 of the Electrical and Electronic Manufacturers' Association of Canada we find a recommendation to use incentives to stimulate R&D that leads to the innovative process and focuses on selected areas, and I think Mr. Mundy makes the same point in his brief, that is, and I emphasize this, of focusing on selected areas, when he speaks on page 5 of choosing some relatively small corner of technology and concentrating all our resources, both public and private, on specialized production areas.

Now, when the Canadian Chamber of Commerce came before us, their chief request—

**The Chairman:** Which they made with the Canadian Manufacturers' Association in a joint presentation.

**Senator Godfrey:** Yes. That chief request was simply that they wanted the government to subsidize R&D, not on a selected basis but by a 35 per cent tax credit in addition to the ordinary tax deductions. They wanted no concentrations or priorities set by the government. They wanted a 35 per cent tax reduction overall. I would just like your comments on that.

**The Chairman:** This, of course, if I can expand further, touches on the current review of government incentives for research and development, in documents such as the Barbeau Report, which was presented to us as an alternative to current incentives.

**Senator Godfrey:** We asked them about whether or not R&D, funded in such a way, resulted in increased research, and whether it resulted in increased stimulation of such activities, and whether they wanted it to be all subsidized equally, and they said they did. They also said they wanted to eliminate any base period or base year, or any increase, and so on.

**Mr. Mills:** On the electronics side we do not disagree with that. We are probably suggesting two things here. There would seem to us to be national requirements, where the government is probably the customer or the group that will initiate action. That would be one area where there is selection, if you will, of a particular endeavour or of a particular line of research. In the electronics industry, government is a large customer. In addition, however, the electronics industry does participate in a free market, and in that sense I would certainly join the Canadian Manufacturers' Association's approach for that element. But there are still other areas which, I suppose, touch on the social or sovereignty or defence aspects of our business, wherein it will have to be determined by other people—by government, in fact—what is selected and what is pursued, because they would not necessarily lead to a viable free market.

**Senator Godfrey:** Will you just expand on the situation of an industry which is going to do R&D, in any event—and I am talking, for example, about Northern Electric or whatever its new name is, and which is highly successful. They are going to do it anyway, but should the government specifically subsidize them by a tax credit of 35 per cent for R&D over other things? It is a grant, I suppose, in its way.

**Mr. Mills:** Needless to say, I do not presume to have to speak for Northern Electric.

**Senator Godfrey:** It is a part of your association.

**Mr. Mills:** That is true, but I would say that there are many companies that do need that assistance, and that would not do it without such assistance.

**Senator Godfrey:** I am only talking about the companies who would do it anyway. Why should they receive it?

**Mr. Mundy:** May I make a comment on that, Mr. Chairman? What we have to recognize—and this is the point we have tried to make in our briefs—is that we are creatures of an international environment, and more so than most people realize. Our competition is with what other governments are doing for their industries. We have to have an environment which is relatively comparable to the environment that other countries are operating in. I do not like

the word "subsidy", particularly if it is felt that it is being used to subsidize certain firms; but we do have to have some sort of subsidy. These schemes are subsidizing employment and technology, and other things which are national objectives for Canada. That is what they are doing if you are talking about subsidies; otherwise, they are an incentive program for Canadian industry to achieve those objectives.

Now, other countries have a tremendous box of tricks, including taxation incentives, that I think it is appropriate we should take a look at in Canada. From the point of view of the policy-makers, some kind of broad tax incentive has several advantages. First of all, bureaucrats do not decide whether a project is good, bad or indifferent. The company does. On the other hand, they have some disadvantages. You have to be making a profit before you can get any benefit from a taxation incentive scheme, and so there are pluses and minuses.

**Senator Godfrey:** Not in terms of the Chamber of Commerce and CMA proposal. They want a tax credit even if the company would do the research anyway.

**Mr. Mundy:** I am talking about a proposal we put forward to the government under the old scheme—IRDIA—which was a 150 per cent deduction against your income tax of R&D expenditures. My main point, however, is that you have to have a box of tricks, a complete spectrum. We take issue with the Chamber of Commerce and the CMA if they said that this is a panacea for all ills in Canada. It is not. You have to have a complete spectrum of the type of incentive programs that other countries have. Other countries have highly specialized specific incentive programs for project by project. We believe that that is necessary in Canada if we are to compete in this international environment. I would like to return later to some further discussion of that.

**Senator Godfrey:** Is there someone here from Northern Electric? I must first of all congratulate you and your company on the progress you have made on research and development without government help.

**Mr. H. Lloyd Webster, Chairman, Research and Development Committee, Electrical and Electronic Manufacturers' Association of Canada:** We are committed to R&D. We have about a 5 or 6 per cent of sales committed to R&D. To answer your question specifically of why the government should be interested in putting money where Northern Telecom has already shown its willingness, I would answer this way: Northern Telecom feels it has to invest in R&D to be competitive and to make its way in the world. It certainly has borne fruit in the last few years. The opportunity is there for government to invest in success rather than take a share of the risk, to invest in a successful venture and help a successful company to be even more successful. That is the only way I could justify that kind of help for a successful company.

**Senator Godfrey:** You are going to do R&D where it is possible to do it.

**Mr. Webster:** Yes. But we would still like to be able to do more than we are now doing. Certainly there is a financial limit.

**Senator Godfrey:** Surely if the point of government incentives is to persuade you to do more, then the incentives should relate to you doing more and not just what you are doing at the present time.

**Mr. Webster:** That is true. The incentives should be to do those things that are in the interests of the economy of the country. I think incentive in the form of tax relief takes some of the risk away from the company investing in several ventures, all of which will not succeed, if we are taking any risk at all. I think it behooves the government to support that attitude and approach.

**Senator Godfrey:** I agree that government should approach R&D and we are groping our way in this committee to see how it can be effective. I am not sure that spending money, giving your company a 35 per cent tax credit for research that you are doing now and will continue to do if the government gives it or not, is the proper way to increase R & D.

**Mr. Webster:** I think only in the sense that the money is being put in a place where it can be used. The reserves are there and can be harnessed.

**Mr. I. A. Mayson, Vice-Chairman, Electronic Systems Division, Electrical and Electronics Manufacturers' Association of Canada:** I would like to support Mr. Mundy's declarations about the export market. One of the main things we have to face here is that we have a very small domestic market. If we are going to participate in a world-wide competitive business, and most of the high technology products are world-wide businesses, then I believe we have to provide incentives for companies to encourage them to do R&D to enable them to compete in world markets.

**The Chairman:** Before we come to other areas, let's stop there. What are they doing in Sweden, for example? They have a small domestic market. In Switzerland they have a small domestic market. What are they doing there to support their successful export industry that we are not doing here?

**Mr. Mundy:** For one thing, the Swedish Air Force can have any aircraft it likes, providing it is made by Saab.

**The Chairman:** That is the beginning of an answer.

**Mr. Mundy:** That is a procurement policy that we do not have in Canada. Our policy is to buy our major weapons systems outside the country. That is one major difference.

**Senator Godfrey:** Are we going to get into the Arrow? We can discuss it for the rest of the afternoon.

**The Chairman:** Senator Grosart is not here.

**Mr. Mundy:** Another thing is that the Swedes have an extraordinarily subtle but sophisticated interface between their government and industry, and it works. We do not.

**The Chairman:** It is important to bring these facts forward. In terms of incentives to industry, neither the Swedish government nor the Swiss government do as much as the Canadian government does.

**Senator Godfrey:** They concentrate on making watches in Switzerland, and on other things they can do.

**Mr. Mundy:** I do not agree with that. The Swedish government buys from their industries as a matter of policy. We do not. That is a tremendous help to a domestic industry. I mean, I find it hard to agree with that. When you look at the question Senator Godfrey has raised, you have to consider the question of how to fund private and R&D. You fund it out of profits, basically. If there is an



incentives scheme in government which allows you to increase your after tax profits, then that is beneficial to the funding of R&D in Canada. That is the basic argument of those who support some sort of taxation incentive.

**Senator Godfrey:** The Canadian Chamber of Commerce and the Canadian Manufacturers' Association said the same thing. Mr. Drury pointed out, when they brought these incentives in 1972, that there was no evidence that they had any effect upon increasing R&D.

**Mr. Mundy:** How do we know it did not stop R&D from declining?

**Senator Godfrey:** I do not.

**Mr. Mundy:** We do not have to argue about the fact that the state of R&D in Canada is perilous. You agree with that. Surely, what we should be discussing is what do you do to improve that.

**Senator Godfrey:** That is exactly what I am discussing. We all want to improve it.

**The Chairman:** Mr. Mundy, I am sure you will remember that we started in the early 1960s with tax credits as the substantial government program to encourage industrial R&D. Then for one reason or another it was found inadequate or unsatisfactory. So we moved to incentives or grants.

**Senator Godfrey:** IRDIA.

**The Chairman:** Apparently now we are coming back to tax credits.

**Mr. Mundy:** I do not think it is as simple as that, Mr. Chairman. Back in the early days there was a large portfolio of government R&D. Largely through the Department of National Defence we started the high technology industries. I am not trying to pass judgment as to whether or not that was successful. It was a fact of life. Now there is no portfolio or fully funded R&D and the Canadian defence industry has been wiped out.

**The Chairman:** Let us try to divide the pie and say that there is a general need for the government to encourage more industrial R&D in general terms. The government has real R&D needs which can be met by more in-house activities or by contracting out. Your view this afternoon—I do not know if you want to comment on this—is that the best way for government to meet the general need of industry to increase R&D activities is through tax credits rather than grants.

**Mr. Mundy:** No, we have not said that.

**Senator Godfrey:** I asked you if you agreed with the Canadian Chamber of Commerce. You started arguing in their favour.

**Mr. Mundy:** I agree motherhood and virtue any time. We do not object to that.

**Senator Godfrey:** You had better start all over again.

**Mr. Mundy:** I would like to reiterate that the basis of our position is that we have to be internationally competitive. The climate in Canada is adverse in international terms.

**Senator Godfrey:** We all agree with motherhood and that we have to be competitive.

**Mr. Mundy:** We must be able to have a similar package in Canada. We are saying that the main impediment in Canada in terms of secondary industry is the lack of a good, harmonious relationship between government and industry in the focusing of government effort into specific areas that will pay off. That is the basis of our position.

**Senator Godfrey:** And you say it should be focused into specific areas.

**Mr. Mundy:** We think it should be focused into specific areas, yes.

**Senator Godfrey:** But that is not what the Canadian Chamber of Commerce said.

**Mr. Mundy:** I mean, if a company can get some sort of tax concession which other governments are offering, they can exercise their initiative to focus that effort into the right areas. This is not in conflict with what companies will do to have a taxation incentive.

**The Chairman:** Mr. Mundy is telling us now that there are various means by which government can help in this area and we will not get the right mix of remedies or support until there is better rapprochement between different sectors of industry and government.

**Mr. Mundy:** That is exactly it, sir.

**The Chairman:** We said in 1972 that in the first phase the principle of participatory democracy should be used so as to benefit from the practical experience of both business and labour leaders who have had to live with the problems of scale for many years. They know best the competitive, technical, managerial and job adjustments that maximum efficiency will require in their industries. We went on and on about this. Each major secondary manufacturing industry with its immediately related sectors would be asked to set up a task force and prepare a re-organization plan incorporating desirable mergers and product specialization schemes together with employment and regional implications and the form of governments required. We suggested that, and then proceeded to make specific recommendations.

I remember that your former department—you were there at that time—did nothing to achieve this, and we received quite a number of objections from industry to this kind of approach. Now you come, four years later, and say this is the solution.

**Mr. Mundy:** With all respect, Mr. Chairman, I was not deputy minister; I was assistant deputy minister at that time.

**Senator Lang:** Which is even more important.

**Senator Godfrey:** We notice that you did not say he was the minister. He knows who runs it.

**Mr. Mundy:** I think Senator Godfrey has a good point, and I would like to try to help give him the flavour of the industry approach to this. Canadian industry, by and large, is struggling with a system whereby the incentive program is 50 cents on the dollar, which admittedly can go higher than that, such as in the case of the DIP and PAIT programs and all these alphabet soup programs. While the norm is 50 cents on the dollar, we can go higher than that, but if we do we have to pay 50 cents on the profits. The competitive environment, again, is not the environment in which the Germans, French and Swedes operate. They are

operating in an environment in which those programs are not only 100 per cent funded, but they get profit on top of it. So you must recognize that when our industry gets into those incentive programs it must put up the 50 cents on the dollar itself, and it gets no profit from it. The 50 cents comes from the profit. Now, anything that can be done to improve the profit situation of those companies is obviously helpful towards their investing in incentive programs.

**The Chairman:** Is this a recent European development? Because I remember very well that when we were in Europe in 1969, and even when we were in Washington and Boston, everyone we met from industry was jealous and sick with envy over the government incentive programs in Canada. Now you tell us that they are more generous.

**Mr. Mundy:** They were jealous because they did not understand that we have no fully funded military R&D in Canada. We had no fully funded quasi-military R&D in Canada. The Americans have an enormous defence budget, with enormous fully funded defence programs. They have NASA, with enormous fully funded quasi-military programs. They have an energy research administration with enormous fully funded programs. There is no such thing in Canada.

**The Chairman:** If in our forthcoming report we resurrect our proposal for sectorial task forces, are you sure that your industry will support us?

**Mr. Mundy:** We will rise up and support it with the maximum possible forces we can muster, because we think the most important single thing government can do is to tell us tomorrow that we will have sector strategy committees organized in which they are going to structure their interface with us.

**Senator Godfrey:** This question is addressed to the Electronics Industries Association: In the next proposal, at the top of page 7, you say that in order to have incentives and encouragement for this effort fast tax write-offs for current R&D expenses are needed. You write them off now.

**Mr. Mills:** Yes. There is no change.

**Senator Godfrey:** Then R&D expenses without regard to previous levels of spending. Is that not exactly what the budget of 1972, passed in 1973, introduced by Mr. Turner accomplished, because would you not describe a 50 per cent tax write-off and a write-off in two years as a fast write-off?

**Mr. Mills:** Yes. How long was that in force, though?

**Senator Godfrey:** It is still in force.

**Mr. Mills:** It is still in force today. The wording here is, perhaps, not sufficiently clear.

**Senator Godfrey:** I just received a week or 10 days ago a publication entitled, "Issues in Government Expansion Role", which is sponsored by the Canadian Economic Policy Committee, the C.D. Howe Research Institute and numerous very distinguished people you will recognize. In table 8, page 49, they show for manufacturing industries the effective corporate tax rate which really reflects the effect of these fast write-offs and lower corporate tax rates. In 1968 the effective tax rate was 45 per cent; in 1970 it was 45 per cent again; and in 1973, 23 per cent. That would be on account of Mr. Turner's budget that was introduced in 1972. Since that time, I think in Mr. Turner's

budget of 1975, there was a 5 per cent investment tax credit which was in force for at least two years, which would lower the effective tax rate.

**The Chairman:** It was an unconditional reduction for the secondary sector.

**Senator Godfrey:** No, it had to be earned.

**The Chairman:** No, I do not believe so.

**Senator Godfrey:** However, in any event I presume it would lower that. I do not quite understand what you are talking about here.

**Mr. Mills:** The remark here, as I recall, was meant to, in effect, substitute for a PAIT kind of scheme; in other words, rather than having to administer or justify programs and have them administered, and so on. Naturally, there is the current write-off of R&D expenses. In addition to that, though, perhaps another 50 per cent would be allowable as a write-off in addition to the 100 per cent, so that that, in effect, would form a grant if there were no profit, or a reduction in taxes if there were profits. It seemed to us that that would be a simpler thing to administer and still leave companies the freedom of choice as to what to indulge in by way of development or research.

**Senator Godfrey:** You are back, then, to the tax credit, obviously.

**The Chairman:** It seems to me that industry wants to have a Canada Council without the peer system.

**Senator Godfrey:** On the same point, Mr. Mundy, in your brief on page 6 you say that "First and foremost, the people at the top must recognize that the future of the country rests on solving the growing crisis in Canadian secondary industry." A couple of sentences later you say that "The business community doesn't see any real evidence as yet that there is recognition in Ottawa of this essential fact."

What explanation would you give of Mr. Turner's budget and the fast write-offs on capital expenditures, the reduction for manufacturing industry for fast write-offs, and so on, if they have not recognized the importance of the manufacturing industry? There was a reduction of the effective rate from 45 to 23. Is that not a recognition?

**Mr. Mundy:** We are grateful for any small mercies, Senator Godfrey. Let us not be ungrateful about them.

**Senator Godfrey:** I suggest you are being ungrateful, from the wording of this brief.

**Mr. Mundy:** But what are the facts? The facts are that secondary industry in this country is moving into a uncompetitive position. The environment here is an extremely difficult one. We have people who have entered into the innovative process, which is the real salvation of this country. They have established in Canada a capability to build a product, to research, develop, design and produce a product, and what are they doing? They are moving into other markets and establishing duplicate facilities because the situation is better.

When you talk about taxes you have to look at them in the overall position. What about personal taxes? What about the effect on senior executives? It is well known that if you hire a senior executive from the United States, you have to pay him about one and a half times what he gets there, because of the personal tax bite. So we are talking about the total environment that exists in Canada.



**Senator Godfrey:** But there has been some recognition, surely, by the government.

**Mr. Mundy:** There has been some recognition. Mr. Turner's initiatives here were statesmanlike and were greatly accepted by the business community, but unfortunately the total package has not done the trick in terms of national objectives.

**Senator Godfrey:** Reducing the rate of corporate tax in the manufacturing industry by one half has not accomplished it?

**Mr. Mundy:** In itself it has not accomplished it.

**Senator Godfrey:** We have a lot of money for nothing, then.

**Mr. Mundy:** I do not think it is a lot of money for nothing. It is the total environment which you have to look at.

**The Chairman:** I believe Mr. Rapsey wishes to make a comment.

**Mr. Keith Rapsey, Director and Former Chairman of Allen-Bradley Limited:** The fast write-off which has been mentioned here as though it were a tremendous tax advantage is, of course, not a tax reduction at all. It is simply a tax postponement. It does have the definite advantage of some cash in the mit which can be retained in an expanding period when it is necessary to expand facilities and plough money back into the operation. But a fast tax write-off is not and never has been a tax concession.

**Senator Godfrey:** Come on, now; a tax postponed is a tax saved.

**Mr. Rapsey:** A tax postponed is a tax that you pay next year and that gets counted into the Anti-inflation Board figures too, unfortunately.

**Senator Godfrey:** I am glad to see Mr. Rapsey here. I don't usually remember things even from one week to the next, but I remember that about six years ago Mr. Rapsey was appearing on a panel on which there were some government ministers and they were talking about cooperation between government and industry and he said, "Hell! Cooperation? It is like a rabbit lying down with a fox." I don't think you have identified the Canadian Manufacturers' Association as a fox, either.

Without getting into the philosophical aspect, either, Mr. Chairman, there are certain companies which are continually expanding because of fast write-offs in capital. They just never get round to paying taxes because they just keep on expanding. So it is a real concession so far as tax flow and encouraging people to increase facilities, which of course is what we want.

**Mr. Webster:** Mr. Chairman, I do agree with Mr. Mundy's approach that, certainly, the measures taken by Mr. Turner in tax concessions were helpful, but that the total environment is still quite hostile to Canadian industry. In the case of my own company, the environment is much more attractive to manufacturing in the United States than here. Of course, we do not do that for this Canadian market, but it would pay us. That is a serious business condition to face.

**Senator Godfrey:** Is this because of the difference in costs of productivity, and so on?

**Mr. Webster:** It is productivity, it is labour costs, it is tax arrangements, it is the cost of materials: everything is conducive to low manufacturing costs in the United States. As a matter of fact, if we manufactured there I think we could even apply as a DISC corporation and obtain relief, and we would have the right to export into Canada from the United States plant and probably land our goods cheaper than we can make them here. We would like, as a strully chauvanistic Canadian company, not to be in that position. We want to be able to manufacture in Canada and export everywhere, if we can. Most certainly, we want to be able to produce for the domestic market.

**Senator Godfrey:** You are starting some operations in the United States now, are you?

**Mr. Webster:** Yes, we are expanding our markets into the United States and, of course, we have to expand manufacturing there to be competitive at all. I think Mr. Mundy certainly has a point that, in spite of all the things that have been done in good faith by government, they are really not enough to offset the whole lineup of disadvantages that we face here at home, and that we should do something about.

**Senator Godfrey:** When the Canadian Chamber of Commerce appeared before us I mentioned that I had been to the Canadian Tax Foundation forum a few years ago just after these tax concessions were made, and there was an expert there from the United States. I believe Mr. Turner's concessions were partly in response to the DISC program in the United States. In any event, in the opinion of this American expert they cancelled each other out.

**Mr. Webster:** They were an offsetting factor.

**Senator Godfrey:** They were an offsetting factor and in fact sort of reintroduced the equilibrium between United States and Canada, tax-wise.

**Mr. Webster:** It is one of the positive factors.

**The Chairman:** There was a report published by the Science Council some years ago about innovation in a cold climate. I wonder if it would not be possible—it certainly would be most useful not only to us but possibly to the government—for the industrial sector, through its industrial associations, to put their story into this kind of international setup, showing the kind of benefits other countries give to their domestic industries to innovate. I do not know of any study which has been made from the point of view of industry. I remember that this study by the Science Council was rather superficial. They did not deal in international comparisons at all in terms of tax treatment or procurement and the like.

**Mr. Mundy:** I think you have a good point, Mr. Chairman.

**Mr. Mundy:** We ought to do this, if we can find the resources for coping with current crises.

**The Chairman:** All right. We will try to find a government grant.

**Senator Lang:** If I recall correctly, when this committee was in Europe in 1969 it became quite evident that programs such as PAIT, which had been tried in European countries, had, by and large, produced the same rather mediocre or negative results that we have now experienced here. Do you conceive that this type of program—that is, tax incentive programs to encourage R&D—would in fact

work if the interface that you suggest between government and private industry were more satisfactory? Is there something inherently wrong with that type of program, or does the fault lie in its administration, or with the attitude of the government as exemplified by its administration of such programs at the interface with private enterprise?

**Mr. Mundy:** I have to be careful what I say. These guys are our "friends".

**Senator Lang:** This is one of our problems on this committee.

**Mr. Mundy:** Let me try and be objective, senator. If you take, for example, the Defence Industry Production Program, and you take a look at its results, I think you will find, if you have the Department of Industry, Trade and Commerce here to testify, that up to March 31, 1974, they had a payoff of 13 to 1, counting the failures as well as the successes, in terms of sales, compared to investment money in the program. As these programs run for maybe 10 or 15 years, if you count the total sales that are likely to be made of the product, this payoff comes to 27 to 1. I think you will also find that 15 per cent of the programs failed and 85 per cent succeeded, in terms of sales that were made and went through to production.

I think, therefore, that you have to remember that basically DIP is a program, to help defence and related defence industries with regard to either defence or civil projects, and that it is a sharing project with industry, and also sometimes with foreign governments, and that by either the government yardstick or by industry's yardstick those programs have been successful. So I think my simple answer would be that we want to maintain that type of rifleshot, highly focused, type of program to deal with the particular problem.

The particular problem that the program I have referred to was dealing with was, how do you maintain industry after you cancel all the major defence programs that resulted from the Arrow debacle. That was the answer of the government, to try and maintain our industry, and if you look at it objectively I think you must agree that it was highly successful. We converted Canadian industry from an inward-looking, cost-plus supplier of our own defence department into an internationally oriented, highly competitive industry, selling in fiercely competitive markets.

**The Chairman:** What will happen to STOL now in terms of external markets?

**Mr. Mundy:** That is a big subject, Mr. Chairman. I hope I can try and summarize our views on that. We think that this is a classic example of a situation in which there is a modest success—I mean, that DASH-7 aircraft is going to sell and sell well, there is no doubt about it. STOL, as a term, applies to the whole transportation program, however. It is a transportation system which includes the ground facilities, the air facilities, the avionics, the aircraft, and so forth.

Despite the fact that we are going to have success in certain areas, like the DASH-7, my own view is that as a country we have failed to come to grips with an area of excellence we had a decade ago and in which we had a lead on the rest of the world. My own analysis of the situation was that the failure, really, lay at the door of the inability of the system to cope with interdepartmental, multidepartmental, objectives. We had the Ministry of Transport, with their own particular interests in the demonstration pro-

gram, and Mr. Jamieson took a very brave decision in embarking on that demonstration program between Ottawa and Montreal. We also had the people in DOITC supporting DASH-7, but you had to put the whole thing together, and you had to have some delegation of interdepartmental decision-making authority in order to arrive at the conclusion as to whether or not this should be a national STOL program with a major endeavour by Canada to get into world markets.

In the event, because there was no machinery of government to deal with this sort of situation, it never even got to cabinet, and the leaders of the country do not know whether it should or should not have been supported as a national STOL program. A large number of civil servants and people from industry think it should, but it never even got up for decision, because of the inability of our managerial system in government to cope with a major technical, industrial program that crossed interdepartmental boundaries, and this is really the song I am singing: other countries do not do that. They have a system that enables them to handle that sort of thing, and we do not. It is absolutely vital that we solve this organization problem in Ottawa, and that is the main thing that we think ought to be done.

**The Chairman:** You mean that there was a disagreement at the level of top civil servants, so that, lacking a consensus there, cabinet had nothing to consider?

**Mr. Mundy:** That is correct. There was no advocate of a STOL transportation system as a whole; in fact, there was no machinery even to look at to enable us to decide whether it was good, bad or indifferent. We recommended four years ago that there be established a program management office, staffed by the Department of Transport, the Department of Industry, Trade and Commerce, and industry, specifically, to look at whether it should be a national program, but nothing came of it.

**Senator Bell:** Mr. Mundy, at the top of page 7 the brief speaks about a managed and sophisticated dialogue between industry and government on a sector-by-sector basis. Would an example of a managed and sophisticated dialogue be the one you have just referred to?

**Mr. Mundy:** I think it would, yes. It would be an example. You need a specific organization to deal with a major problem like that. You need somebody like a project manager. You need ministers to delegate certain responsibilities for that project management team to take a look at. You need to involve industry; you need to give them specific objectives. You need to get them to make recommendations, not based on the Department of Industry, Trade and Commerce promoting a particular type of aircraft, not based on the Department of Transport's interest in trying to develop the concept of city centre to city centre STOL use, based on the interests of the country, in terms of our future development and our export trade, and in terms of what happens if we put our resources into a STOL transportation system. So I would call that a managed and sophisticated dialogue, but I would also call a sophisticated and managed dialogue what your committee has recommended, and that is sector consultative studies, which have an agenda, and representation from industry that really speaks for industry, and which has interdepartmental representation on it, not representation just from one department, which is focused on some specific objective for a particular segment of industry and in which the two sides are equal. That is what I would call a managed and sophisticated dialogue.



**Senator Bell:** That should fit in very well with the electronics people's point that if there is support for manufacturing of military communications systems, and so on, there would be some spinoff for civilian and domestic marketing; so that if you have this interdepartmental discussion, on a managed basis, it should make the whole thing move forward together more soundly. Is that not so?

**Mr. Mills:** Yes, I think so. In fact, I am sure that the base from which we proceeded a year ago was established as Mr. Mundy was indicating, from spinoff from the aftermath of the defence spending days.

I would like to comment on Mr. Mundy's remarks in general. I agree with all that he has said, and I think all that he has said pertains more particularly to national programs, programs that have national goals and purpose, and, of course, electronics is vitally concerned with that. But in addition, and perhaps more so than with other industries, we are always concerned with products that are much smaller and do not involve national purpose or national goals.

To return to the senator's observation or question about PAIT, as an example, as a means of fostering product development, I think it has served its purpose well. It has served many companies. It does seem to most electronics people that it is perhaps a cumbersome or not easy way. It is not easy to start up. There is a lot of preparation, justification and all the rest of it involving other people in order to start such a program. For much the same reasons it might even be so that there is a certain inertia, having started it, and that perhaps it should be stopped sooner than it might otherwise be stopped because there is this involvement with a government department. So, I guess I have covered the spectrum on the one hand. I like what Mr. Mundy said about national goals, but that is not the only answer. There are small profitable products in business to be had at the other end of the spectrum.

**Senator Godfrey:** Can we pursue the second part? You have not really touched on it. You are with Westinghouse and probably knowledgeable in that area. This is on the question of importing technology. Is there any point in duplicating technology that has already been produced in the United States, for example, by your parent company? I can appreciate that in order to import technology you must have some technological equipment here. How does it actually work out in your company, for instance?

**Mr. Mills:** Speaking from my own personal experience in the electronic side, we have not imported that technology. The products we handle are of our creation. They are, if you like, assigned to Westinghouse Canada as their products to pursue. It is of our creation.

**The Chairman:** For world markets?

**Mr. Mills:** For world distribution. So, on that score, which I am knowledgeable in, we are not importing technology. If one says that there is no point in doing something because someone else has done it—when one looks at the United States, I do not know what is left to be done. They have done just about everything, or will have. There will have to be duplication on the broad scale just to lift ourselves up to get to a common starting point.

**Senator Godfrey:** Do I understand you split, in effect, research and development? There is a certain amount in the United States and a certain amount here?

**Mr. Mills:** I was referring to electronics as a segment of our company, of which I have some specific knowledge. That is a separate division from other divisions.

**Senator Godfrey:** Are they consumer products?

**Mr. Mills:** No, not consumer products.

**Senator Godfrey:** I was thinking more of consumer television. I understand Zenith spent \$22 million in research and development and that Electrohome, which I see is losing money, spent only \$2 million. How do they compete?

**Mr. Mills:** Does anybody have any views on that? I am not familiar with that sector.

**The Chairman:** To come back to government relations with industry and incentives, I am sure you are aware of the Sharwood study, which is considering, according to rumours, how incentives to industry will be organized in the future. Have you been consulted during the course of the development of that study?

**Mr. Mundy:** Yes. According to Gordon Sharwood, we were the only industry that was consulted. I suppose that is largely because we shouted louder than the others and we said, "you have to talk to us because there is a learning process." We had a discussion with Mr. Sharwood and it was largely centred around this U.S. connection. We felt that he was not fully aware of what the importance of the U.S. connection was to Canada, particularly in the military sphere. We made several points to him. We made the point that a program like DIP is not just an R&D incentive program. It is support right through the product cycle for production and marketing. This is tied to product sharing. The government made the marketing agreement with the United States which said, "You have duty-free entry. You are the only country in the world that has this access." So we are on an "equal basis with U.S. industry". I put that phrase in quotation marks because, if you will pardon me, we do not have any American senators looking after us. We were satisfied that the market entry was a good one. As an industry we put out a major effort and got into that market, from which we were virtually excluded before, on a so-called equal basis. It was an effort that was right through the product cycle. That is the first point we made to Mr. Sharwood. For instance, the CCC, a government agency, actually handled the contracts. This is an indication of government having what I call a sophisticated interface with industry and a complete arrangement of a complicated nature to help industry.

The second point we made, which I mentioned a little while ago, was that there is no fully funded R&D program in Canada, and that the DIP program is the substitute for that.

The third point we made is that this military connection with the United States is largely through this R&D net, and the availability in the United States of joint funds to help finance projects in Canada which are directed at U.S. requirements, which is an agreement we made with Mr. McNamara when he was Secretary of Defence. It was one of the main aids we had in that program.

Finally, some of the objectives of this program were related also to preparedness in this country. If we were handling military projects that we bought in the United States, we had to have some knowledge of that technology if we were able to even repair and overhaul them, let alone produce bits and pieces. Mr. Sharwood, I think, got an

insight into the importance of a program which perhaps had not been all that popular because it was defence oriented. The defence orientation is important for civilian technology in our industry and in the electronics industry because that is where the advance technology comes from.

**The Chairman:** Were you consulted by Mr. Sharwood?

**Mr. Mills:** I think the first inkling I had of it came about through the proceedings of the CMA meeting, and I inquired around since then. As near as I have been able to ascertain we were not consulted.

**The Chairman:** This committee was told that there had been wide consultation with industry. You are telling us this afternoon that you were the only association which had been consulted.

**Mr. Mundy:** That is what he told us.

**Hon. Mr. Balcer:** Mr. Chairman, we were quite disturbed because our association was not consulted. Of all our member companies that have been asked, not one of them were consulted and they were disturbed about that.

**The Chairman:** I am glad to get that information. You are not the first one to say you were not consulted. But we were told otherwise by the Department of Industry, Trade and Commerce.

**Senator Godfrey:** Did this success that you had in the United States come about because of specialization and special qualities that Canadian companies had?

**Mr. Mundy:** Specialization was one of the factors. For instance, Pratt and Whitney went for small gas turbines; Marconi went for navigational aids, and Leigh Instruments went for data recorders. They made that pay off by specializing in those areas.

**Senator Godfrey:** Could we ask you to comment on the closing of the RCA labs in Canada? I believe they were heavily subsidized or encouraged by government. I see they have packed up and gone back to the United States. Are you familiar with that at all?

**Mr. Mills:** I am not, but perhaps some of our members are.

**Senator Godfrey:** I gather they have received government support in the past and suddenly it is gone.

**Mr. Mayson:** There is some misunderstanding about the RCA labs. The RCA labs have been in existence for a long time and have supported several divisions, including the Canadian company. They undertook a lot of contract work not related to the various businesses in which the company was engaged in Canada. A decision was made to restructure the labs and fold back into the individual businesses the areas of the labs' work that was associated to that division and to not pursue the other activities that the labs engaged in that were not related to the company's business. The vast majority of the dollars that were subsidized, if you use that word, were in the businesses that were engaged in product work, so that has been turned back into the businesses.

**Senator Lang:** May I revert, Mr. Mundy, to your remarks with reference to the importance of the U.S., particularly in the military field. You refer to that in your brief where you say that the general climate between the American and Canadian governments is a vital ingredient to our

success in these markets. Could you describe the climates today and in a comparative sense?

**Mr. Mundy:** I feel that is really getting more into the political field. What I would say is that at the work level the United States administration is trying very, very hard to help us. There is no doubt that they are committed to arrangements such as production sharing which they believe are in their interest, an arrangement which is beneficial to Canada, but they think it is in their interest because it helps military cooperation and helps to reduce the cost of armaments. However, it is a special relationship which we have with the United States. It is not true that the special relationships have all gone. That is a special relationship. The British and the Germans would love to have some kind of arrangement such as that. So at the administrative level I would say that the climate is quite good. It has improved recently through the purchase of the long-range patrol aircraft, because this has brought the balance of trade in defence production, or will bring it more into equilibrium between the two countries.

However, we are constantly subject to some ups and downs. You must remember that these agreements are not cast in tablets of stone. The Americans can turn that off any day they like, without saying a thing to our embassy in Washington or to our cabinet. It is an agreement based primarily on goodwill and anything which deteriorates the climate with the United States will tend to cause some deterioration in that goodwill. I believe that is all we are saying.

**Mr. J. D. MacNaughton, Vice-Chairman of the Board, Air Industries Association of Canada:** Mr. Chairman, when these arrangements were first entered into, the Canadian dollar was at 92.5 cents American. Canadian labour rates, including fringe benefits, the whole package, were substantially less than those in the United States. So it was truly in national interest of the United States, as well as for the global aspects of North American defence. They could get a damn good deal by buying Canadian. That has changed dramatically in the last two or three years; it is all topsy-turvy. Our labour rates are up there and although it is goodwill at the policy level, it is becoming increasingly difficult for firms to be competitive, although the arrangement is still in effect.

**Senator Yuzyk:** Unless they improve their productivity.

**Mr. MacNaughton:** That is right.

**Senator Yuzyk:** Could we return to this sophisticated dialogue between industry and government, which I consider to be very important and which I gather has not been initiated?

**Mr. Mundy:** There are only one or two isolated industries, such as the Defence Industrial Productivity Program and the make-or-buy program in which it seems to be working.

**Senator Yuzyk:** So there really is no mechanism as such to get on with the dialogue. Then, do you not see that there is a role there for MOSST to play? Can MOSST not be an important factor in this, and is this not one of the functions of the ministry?

**Mr. Mundy:** Senator, I am treading in areas that are really rather difficult for me to comment on here. I can only observe that MOSST is a ministry of state that did not have any money. The Department of Industry, Trade and



Commerce has money; it also has a mandate to improve the competitiveness of productivity of Canadian industry. I believe that some of us think that MOSST could play a much larger and more useful role.

**Senator Yuzyk:** Which it is not at the present time; is that not right?

**Mr. Mundy:** Yes, but obviously we cannot take sides in this. Our concern is with the government as a whole, and if the Department of Industry, Trade and Commerce is the agency of the government which deals with us, that is a fact of life. Obviously, they are the people with whom we have to work on such strategies, because that is their mandate.

**Senator Yuzyk:** You would not try it through MOSST?

**Mr. Mundy:** I do not believe we could.

**Senator Hicks:** It is not really their decision; that is the decision of the government, surely.

**The Chairman:** But, since Mr. Mundy alluded a moment ago to the fights between baronies within the public service, perhaps that is precisely because MOSST has no budget and has been given the role or the mission by the government to look at these inter-departmental relationships, that perhaps they could play a more visible role, even more so since they have been given the additional mission to advise Treasury Board on proposed R&D expenditures.

**Mr. Mundy:** Yes, I think that is quite true.

**The Chairman:** And I would think that if you feel that the doors are closed, or not sufficiently open, in the Department of Industry, Trade and Commerce, you might try this other door. I do not think that this would be an impediment.

**Mr. Mundy:** Yes, we believe that the Department of Industry, Trade and Commerce is about to embark on some sector strategy consultative committees.

**Mr. Sydney Young, Chairman of the R&D Committee, Air Industries Association of Canada:** Mr. Chairman, I just wish to comment that the difficulty we have in answering that type of question would reflect back to the cancellation of the defence industrial research program, which was essentially related to pure research and not related to development and subsequent marketing, although normally this comes later on. We are connected with research in industry, and I am sure we are not alone; a number of our companies have been affected by the abrupt cancellation. We held within the first seven months of cancellation three major meetings, which I would call interdepartmental in that we invited people from various ministries of government to attend and they did so. The point is that it took a long period of time, longer than seven months, for some of our member companies who had been doing research programs and wished to continue them, to have them supported by other departments of government due to that sudden switchover. I am not referring to the larger amounts; these are fairly small contracts in total dollars, ranging from \$100,000, \$200,000 to \$300,000. At times the administration size could be a little bit like a super tanker; you have to apply a lot of energy and wait a long time before you can turn it around. That just gives a small indication that it is very, very hard if you want to carry on research in this country and if you wish to get government incentives for it.

**The Chairman:** Can we spend a few moments discussing the make-or-buy policy, because this is the other aspect, together with unsolicited proposals.

**Senator Lang:** May I ask a general question of both witnesses which applies to this area? Underlying both your briefs is the concern with respect to the continuing level of in-house R&D as opposed to the declining level of support in R&D in industry. I have never been able to get a picture as to the benefits that industry may or may not receive, or has or has not received in the past, from government in-house R&D generally.

**Mr. Mundy:** The make-or-buy policy . . .

**The Chairman:** Senator Lang's question was really not directed to the make-or-buy policy.

**Mr. Mundy:** Well, it is related to in-house versus out-of-house industry contracting. The great benefit of this contracting by government out of house is that this is fully funded, contrary to all of these incentive programs. You get your labour, your material, your overhead plus a profit. In other words, it is one of these fifty-fifty types of programs or perhaps you can work it up to seventy-thirty.

**Senator Lang:** That is really not my line of inquiry. I know, for instance, that NRC turns out patents which go to the Canadian Patent Development Corporation. What comes out of those? What comes out of government in-house R&D which either of your industries has been able to benefit from.

**The Chairman:** As opposed to contracting out.

**Mr. Mills:** Has there been any spinoff from government laboratories? Is that your question?

**Senator Yuzyk:** Or direct applications of findings in laboratories.

**Senator Lang:** Or by hiring researchers or whatever.

**Mr. Mills:** To my knowledge it has not been too great, not at least from my experience. Perhaps some of our members might have some pertinent experience which they can address themselves to on this subject.

**Mr. K. F. Gibson, Leigh Instruments, Air Industries Association of Canada:** Mr. Chairman, I should just like to speak out on this point since I work for a company which was founded by R&D done in government laboratories. Certainly in the past my company has derived significant benefits from research done in government labs. At the moment we are working very closely with government labs. So I would like to speak out at this point.

**The Chairman:** With what specific laboratory?

**Mr. Gibson:** With NRC. The company was virtually founded on an invention which emanated from NRC, and most of its success was based on that product.

**Senator Yuzyk:** Did the stimulus come from NRC or did you take the initiative yourself?

**Mr. Gibson:** The stimulus in that particular instance came from NRC.

**Senator Lang:** That would apply to SPAR, too, would it not?

**Mr. Mundy:** We have a SPAR representative here.

**Mr. MacNaughton:** Mr. Chairman, the most dramatic example at SPAR is the STEM device, the storable, tubular, extendable member used for spacecraft antennas, and that was an NRC invention. Its trip from the NRC laboratories into industry was a longer process than that of the crash position indicator. The idea lay dormant for a number of years until Canada embarked on its satellite program with *Alouette* and the need was discovered for a very long deployable antenna. It was somebody in another government laboratory, the Defence Research Telecommunications establishment in those days at Shirleys Bay, who remembered that this invention had been made at NRC and it was picked up. SPAR picked up a license through the Canadian Patent Development Corporation and proceeded to sell it competitively onto spacecraft of United States, Japan, Germany, France, England, et cetera. So that was a good example. We have had some bad examples, too.

**The Chairman:** Do you feel that the representation you have, that industry has, on the board of NRC is adequate.

**Mr. MacNaughton:** I do not think I am really qualified to answer that.

**Mr. Mundy:** Well, Mr. Chairman, I think the answer would have to be no. It is hard for anybody from industry to go onto a government board with not that much familiarity with what they are doing and make any large impact on their program of work. I am not really convinced that that is a successful method of establishing a link between industry and government.

**The Chairman:** And yet there is a board there and it is composed almost exclusively from outside people. There is a great representation from the universities. Their responsibility is to give the general orientation to the research being done in these great laboratories. It seems to me that if the people from industry are not knowledgeable enough to have their say in the general orientation of these labs, why should the people from the universities be considered more equipped to do that and to give that kind of advice.

**Mr. Mundy:** It is hard to be critical of NRC, because we feel they have supported industry, and our industry in particular, extremely well in recent years. But my own comment would be that the mechanism, whereby you get an industry input and you influence the actual programs of work of the National Research Council and other agencies of government so that they are directed more towards what industry wants, needs improvement.

I am not criticizing NRC. By and large it is generalists who sit on their board.

**The Chairman:** It is difficult for us, when you come and say there is too much intramural research and then on the other hand say, "Leave NRC as it is with their present budget." I do not know where the shift will come from.

**Mr. Mundy:** NRC have been the leaders in contracting out. They have an extremely good record in the make-or-buy program in contracting out.

**The Chairman:** In terms of your industries, who are the sinners in government in terms of intramural activities?

**Mr. Mundy:** The sinners are the system. As you pointed out, and we pointed out in our brief to the government, we are the reverse of other countries in the world. We have about two-thirds of our research done in-house and one third in the industry. The rest of the world has the reverse.

**The Chairman:** If we want to change this trend, we have to identify the sinners. You say that NRC is not the sinner. Where are they? Is it agriculture?

**Mr. Mundy:** The system is the sinner, but I think the system is being changed, and the make-or-buy program is the vehicle by which it is being changed. We all have to be patient. Maybe we will be under ten feet of sod before it is really changed, but I think we are moving in the right direction.

**The Chairman:** And yet you see that the electronics industry tells us that the make-or-buy policy is in large measure used to extend the staff of some government R&D departments, and that it has had a very insignificant or marginal effect on the R&D in industry. On the other hand we are told by the government people that the make-or-buy policy has reached its full potential and that they cannot contract out more than they have been doing. So where are we going to get that shift from government to industry?

**Senator Hicks:** Mr. Chairman, it seems to me there is an underlying assumption in what you are saying that the sum total of research and development in the country is correct. Surely we have had all kinds of evidence that that is not so. It is not a question of us wanting to cut down on so-called in-house research. It is a question of us wanting to find some way to increase the research being carried on by industry and, as other persons have said, by the universities as well. But no one has really suggested that we should cut down on the in-house. Even the most avaricious persons representing academic disciplines from the universities here did not say that the in-house research should be cut down. They said that it should be frozen so that more funds could be transferred to assist research in other institutions in the country, including industry and including universities. If we did that, then we would move upwards, more nearly toward the average achieved by developed countries, the proportion of our gross national product, for example, that is expended on research and development.

**The Chairman:** Do you agree with this? I thought that this afternoon we had heard there was too much in-government.

**Mr. Mills:** I suppose that position stems from the fact that we assume there is a limited amount of money in the economy that can be devoted, or that we are willing to devote, to R&D. Given that as the case, and it may not be true, but given that as the state of affairs, it seems to us only by a transfer of work or funds from one to the other would that be increased. If it could be done in the way you suggest, senator, then we would have the best of both worlds.

**Senator Hicks:** No, it would not. We would just come closer to the other developed countries, that is all.

**Mr. Mills:** I would not say that I would be totally satisfied, but I still say that we would have the best of both worlds, inasmuch as government would be unaffected, and industry itself would have been lifted up.

**Senator Hicks:** I resist the assumption that the pie is made of a certain size and that all we can do is to juggle the size of the pieces which stay with government or are contracted out, or are done by industry by arrangement or some other agency in society. I think the general level of our research and development effort in Canada bears out the position I am trying to expound now.



**Mr. Mundy:** I agree with the senator, and I think the most favourable development in "make or buy" is the unsolicited proposal route, with bridging funds in the Department of Supply and Services, and by definition these are proposals which are funded out into industry. I think progress has been made there but not enough, and we have all got to work hard and try to improve that situation, because this is one of the routes by which we are going to get this portfolio of innovative, export-oriented technology-type product lines developed in Canada.

**Senator Carter:** Do we have excess research capacity in industry that we are not using? My understanding was that this disproportion that we have, which Senator Hicks referred to, is due in some measure to our branch plant economy, in terms of which the main research capacity exists in the parent countries which is easier and better for us to import than for us to develop ourselves, so that therefore we do not have in industry the capacity that we need to correct the balance.

**Senator Hicks:** We do not have the incentive in industry to perform it.

**Mr. Mills:** I would agree with that, yes. The capacity, if it is not there instantly, would soon be created. The potential is there, the talent is there, and the universities can provide that talent in the form of graduates and masters, and so on.

**Senator Hicks:** I am a little concerned this afternoon, with regard to the positions taken by both the electronics industry and the air industry, to see that the fact that more research is not going on in Canadian industry is laid clearly on the doorstep of the government. The tax incentives that have been offered are insignificant in the eyes of Canadian industry, although until this afternoon I felt fairly confident that they did compare reasonably with many other countries. It was possible that they were not the best, but they certainly were not the worst. In other words, we might have spent a little more time this afternoon, if we had been so inclined, criticizing Canadian industry for not contributing a greater proportion of the share of research and development that ought to be carried on in Canada.

**Mr. Mundy:** Well, we would be quite willing to accept criticism of our industry, because, you see, our brief says that the initiative has to come from private industry to develop this portfolio of innovative, internationally-oriented projects. So, we are prepared to accept the blame, or part of the blame, for not trying to do something more about research and development, and whole innovative process in Canada.

The theme, however, that we are outlining here is that our companies are in a difficult environment if they are export-oriented, and they all are in that we do not have an environment which is really favourable to encouraging them to go out and take risks.

The second problem that we have—and it is really an associated one—is that our competitors have a smooth relationship with government which we do not have, and more and more we are dependent upon governments for opening doors and giving incentive programs, or at least being some sort of partner in the exercise. So, it is vital that we get into a situation where, first of all, the people at the top are convinced that the future of this country, and the way we are going to make our world, lies in trying to get a more harmonious relationship established with the

industrial community in resolving that they are going to motivate them, going to help them, and that we are going to get this portfolio of new projects going.

If you go back in history you find that our competitors took decisions years ago which we have not taken yet. If you go back to the post-war period in Germany, you find that when Adenauer came to power as chancellor he established as one of the main planks in his program a determination to support and encourage industry to be more competitive, to get larger profits, to export, and all the fundamental policies of the West German Republic were related to trying to motivate secondary industry to be more competitive.

Another example is that of Japan. In 1950, when the Bell Laboratories invented the transistor, and when Texas Instruments, soon after that, discovered how to productionize it and reduce the production cost by several orders of magnitude, the Japanese Government took a decision that they were going to get into semi-conductors. They mobilized the whole machinery of the state to support a semi-conductor industry with the objective of becoming the world leader in domestic electronic equipment—an area that they were not in at all. We all know what happened there also. The Japanese mobilization of their state involved the Department of Finance, MITI, the Department of Industry, their budgetary and fiscal policies, their banking arrangements to support the companies with credit, and their diplomatic arrangements. It was a sophisticated marriage of government and industry, focused on a specific industrial objective.

**Senator Hicks:** It would be naive, in both instances in the illustration you have used, of West Germany and Japan, to give all the credit for that to the governments concerned. It also required an aggressive, outgoing attitude on the part of industry, industrial leaders, scientists and technicians in those countries as well.

Certainly we have all been impressed today by the implied criticism of government that derives from the views that you have expressed here, and I am sure that members of this committee will want to explore very carefully anything they can do to improve the government's attitude. Will you excuse me for saying, however, that in return we also expect Canadian industry to look at the role that it can play, and to be at least as self-critical as you expect us to be of the government's processes on this side.

**Mr. Mundy:** To give you encouragement on that score, senator, I have drafted a speech of criticism of our own industry, which I am going to deliver to them in a week's time at our annual convention. I agree with you that there should be a partnership arrangement.

**Senator Hicks:** Perhaps you will put us on your distribution list.

**Mr. Webster:** As the only representative here of a Canadian multinational that is now investing more than \$50 million a year of its own profits in research and development, I hope we are not included in Senator Hicks' comments.

**Senator Hicks:** I was not being the least bit specific.

**Mr. Webster:** Of course, even taking into account all the effort we are putting in, we do appreciate government help. We do not want handouts, but we would like assistance, if it is possible.

**The Chairman:** What has been the success or failure of this top advisory council of business people that was assembled to assist the Minister of Industry, Trade and Commerce some years ago?

**Mr. Mundy:** I do not know whether I should speak up on this, because I was on the other side of the fence when they met. I was a civil servant.

**The Chairman:** Then perhaps you are the best man to respond to the question.

**Mr. Mundy:** The impression I got was that those members of industry came into an unstructured dialogue. Certainly they had an agenda, but they only heard about it a few days beforehand. They did not really have any meetings, they had no structure that would enable them to organize a consensus of views, they were just senior executives who were dealing with very complex issue, and who were in need of a whole raft of taxation specialists, R&D specialists, and so on, whereas at that stage we in government could field a whole battery of experts who could snow them under on any single question with facts and figures. I do not think that was good dialogue.

**The Chairman:** How would you organize a dialogue at that level? I understand we could organize it at the research and development level, and all that sort of thing, and I think that the electronics industry has expressed several good views about this more specific type of dialogue; but at the top level, how would you organize this so that business would come better prepared?

**Mr. Mundy:** At the top level, say in the aerospace industry, there needs to be some agreement on broad government policies, like restructuring, Canadianization, mergers, offset policy, and the like. However, the real work is going to be done by people like Ken Gibson, who is Chairman of our Avionics Committee, which consists of half a dozen companies whose product is exported nearly around the world, and who will meet with the working level people in the Electronics Branch of the Department of Industry, Trade and Commerce, and with various other people who will sit down and talk about the nitty-gritty. I really feel that is the way to get on with a sector dialogue. Ken is chairman of the committee, so he has a consensus behind him. He is not, you know, Mr. "X", a businessman drawn out of a hat.

**The Chairman:** So you do not believe very much in these top-level discussions that may be useful in producing a kind of gentleman's agreement?

**Mr. Mundy:** Maybe they have improved since my day.

**The Chairman:** I do not think so.

**Mr. Mills:** While it is true what you say about the need of this at the working level, must this not be presented by a fundamental attitude change in policy? This is what is desired. This is what is needed and necessary. The working level flows from that. It is not the catalyst, necessarily. It might be, but it would be swimming upstream, if that is the case.

**Mr. Mundy:** This is a delicate point. We do not believe now that there is any possibility in this country of having some grand strategy for industry. We do not believe it in the sense that we do not think it is going to happen. Nobody has the political will or the capability to do it. On the other hand, we do think that some sort of general ground rules and atmosphere has to be set by the Prime

Minister, and Don Jamieson, the Minister of Industry, Trade and Commerce, where they really support this effort and say that it is vital for the future of Canada. If that happens, the people at the working level will have something to hang their hats on. Unless that happens, they are swimming in the ocean with no guidelines.

**The Chairman:** I wonder if there is anyone here who participated in this top level advisory committee and who would have some views about it.

**Hon. Mr. Balcer:** As far as electronics is concerned, there was only one meeting of senior officers with the director general. There were two, one yesterday.

**The Chairman:** I have just a small point here. Going back to the make-or-buy policy, again the electronics industry has said it had a very marginal effect on the R&D activities of the industry. Yet, the CMA and the Canadian Chamber of Commerce said that as far as the electronics sector is concerned, the contract approach was and is exceedingly useful. Where is the truth? I am sure that your brief is right and that CMA is wrong.

**Mr. Mills:** For the electronics association we were saying that it is perhaps a step in the right direction for creating an attitude and an awareness. When we studied this about a year ago, we came to the conclusion that it had not improved the situation very much. While there are some very nice reports and large contracts shown in the DSS R&D bulletin, it is generally felt that this would have happened anyway. It was not instrumental or additional to what might have occurred. Other observations we made at that time were that it also seemed it might be a mechanism for some government departments to increase their staffs or get additional support because the service sector was one of the main beneficiaries of the policy. In the last fiscal year I notice that there are about 106 contracts that were let in the under \$20,000 range, for a total of some \$13 million. At the other end of the spectrum there were some 25 contracts which amounted to \$66 million. But it was felt that those were hardly R&D contracts. Some of them, were projects with some element of R&D in them. But the magnitude was not \$66 million of R&D.

**The Chairman:** I wonder if you would care to comment about the relationship between the CMA and the Chambre of Commerce. We have a problem here of representation. We had the engineers and the social scientists say that SCITEC cannot speak for them. While they are an umbrella organization which should be in a position to speak, at least on certain issues for the whole community, SCITEC does not seem to represent the views of their membership.

**Mr. Mundy:** Many of our large members do not belong to CMA. But CMA represents a constituency in Canada.

**The Chairman:** What is it? I am sure Mr. Rapsey could respond to this.

**Mr. Mundy:** We take issue with them if their brief says that the panacea of all problems in the R&D sphere is to have a taxation incentive program. We take issue with them strongly, largely on the grounds that it is not that simple. It is a highly sophisticated problem. If you are dealing with international markets, you have to run with the competition. That is not the competition. They have a box of tricks. We have to keep up to that box of tricks. Where would the CMA members be, for instance, if suddenly the government announced they were going to get out of export development financing? Thirty or 40 of their



big members would scream blue murder. It is a fact of life that the government is involved in almost every sphere. That is the system around the world. I do not think you can have some simple panacea like a taxation incentive that is going to solve the highly complex problem. I have not read their brief fully, so I do not know exactly what they are saying.

**Mr. Rapsey:** Mr. Chairman, the CMA of course does represent some 80 per cent of the manufacturing output of Canada and does include some members in the Air Industries Association, the electrical groups and electronic groups, as well. We should recognize that we are looking here this afternoon to industries that are at one end of the spectrum. You have your industries, for instance, with 80 per cent export and, therefore, highly concerned with the export business and relationship with other countries, and so forth. You could go from there to the other end, to concrete blocks, just to pick a product, which by their weight and transportation cost are not exported or imported.

On the type of product where you are in the world market, as Mr. Mundy pointed out, I can see it is very important to take a rifle-shot approach. You cannot be into everything in that area. You have to decide what you are going to specialize in. Mr. Mundy has mentioned this. Therefore, this is the kind of thing that should be supported. When you take general industry, I would be appalled at anything but a general approach. It would seem to me to be impossible to administer it from a bureaucratic standpoint, and there would be a lot of errors made. We just have a great span of different types of industry.

**The Chairman:** We have been talking about a dialogue all afternoon and I am all for that. I am sure that the government ought to be in favour of that as well. But the problem is with whom do we have our dialogue. Here we have this statement by the CMA that for the electronics sector the contract approach is exceedingly useful. Then I go to the electronics industry brief and they say that it is very marginal and that what happened would have happened in the absence of the make-or-buy policy. If we take the conclusion of the CMA, we would write in our report that this policy is great. If we look at the electronics industry brief, we say that it is far from being enough.

**Mr. Rapsey:** The electronics division of EEMAC is undoubtedly accurate. The apparent conflation is more apparent than real, and it probably results from a misreading of figures without getting behind the figures. For instance, just after lunch today that very point was being discussed and it was mentioned, which was new to me, that many of the things which were counted in this head count, or dollar count, of what has been contracted out had already been done before the make-or-buy program was implemented. Therefore, it really was not very fair to say that they had been brought by the make or buy. I do not really know, but I imagine you will find that CMA misinterpreted those figures by not getting behind them, which EEMAC in its presentation has done. So the disagreement, perhaps, is not a real disagreement, sir.

**Dr. F. J. F. Osborne, Director, Communications and Space Technology Laboratory, RCA Limited:** There is not as much conflict as it appears. When doing research you have several different sources of funds. One activity is contracting. By this we really go out and get government money, fully funded with profit on this. These are the interests of the government, which it wants done, be it

military, transportation, or what have you. The next area is cost-sharing. This is where we get the alphabet soup routine. Now the company puts in half its money and hopes for support from the government. I believe it is in the cost-sharing area that we are talking about removing obstacles, which are very significant, believe me. Right now we have been in the process of writing DIP proposals, negotiating, doing presentations, changing the presentation, and so on, and, hopefully, by next April we will have a new DIP program going. That is the sort of time frame you must deal with. That is the area in which we would like to see tax incentives used for 150 per cent write-off. Let us get it out of the government administration, which is trying to look at the market opportunities, the R&D value itself. We are doing the same thing and we end up with the great deal of paper work and big administration, and so does the government.

Finally, there is an area which we all in industry hope to keep at a minimum. That is where we put in our dollars and only our dollars. That we would also like to see doubled up, in effect, through increases of 150 per cent, 135 per cent or whatever you care. However, we have to make it clear that there are two areas to which we are referring all through this afternoon. There are the areas of government-needed R&D, and we feel in the industry that it is only fair that that be paid for by the government and show a profit. Then there is the other area, in which we are trying to get the industry going to produce the exports, and so on. There we are looking for the tax advantages.

**Senator Lang:** I presume with respect to that lag in DIP you refer to, you are negotiating for 50 per cent, or something; is this the quibble there?

**Mr. Osborne:** No, that is not really a quibble, because I think that most of the larger companies that are operating are subject to Canadian government audit, in any case. So usually the rates are pretty straightforward and there is usually very little argument about the cost-sharing ratio.

The problem is that you go in and say you would like to do this area of research, and someone in DOC says that they do not like that area of research, that they do not like the work statement we have developed, and so on. There is a problem. You want to do the program for three years, but you are looking at markets that are five years. It becomes a matter of opinion as to where things are going.

What we do need from the government, although I agree perhaps that there should be some sophisticated dialogue, is for it to come out and tell us where they want to go and where they want to take Canada 10 years from now. You give us some tax incentives and we will get behind you and take you in that direction if we can.

**The Chairman:** You are not referring to the new society.

**Mr. Osborne:** I do not believe so.

**Senator Lang:** That is anticipatory democracy.

**Mr. MacNaughton:** Mr. Chairman, I do not believe that we as an industrial association can support quite what Dr. Osborne said with respect to DIP. I think Mr. Mundy made a perfect case earlier, that DIP is just not a single isolated 50/50 research program. It is part of a very complex arrangement of marketing with the United States military and quasi-military arrangements, such as NASA, which are very important "quasi". This is the entrée into the American military marketplace. So with DIP by itself, a certain

kind of DIP program, maybe tax incentives are the way to do it; with others, no, sir.

**Mr. Osborne:** I agree that we need mixed programs, but we want to avoid more programs with different, types of administration. That is what really is killing us now. We have real funny ones, where the requirement is that "thou shalt" list the individual salaries of every man working on the program. All the rest of our work for the government has gone on an audited rate for a group of men. That is fine. I think it is NRC who wants to know the individual salaries of every man called up. This is highly classified information in a company, yet it is reported monthly to Ottawa. There are different regulations, and the administration becomes cumbersome. I am sure it is as cumbersome on the other end.

**Mr. Mundy:** Mr. Chairman, as an old bureaucrat, I do not think bureaucrats are going to change. The message I am going to give to my industry is that there is a new environment of government overlay of rules and regulations and that if you do not understand that you will not survive. One of the new rules of being a successful businessman in Canada is to know how the government operates, to be able to forecast how it is going to operate and to live in this extremely difficult environment.

**Dr. T. W. R. East, Ph.D., Director of Advanced Development, Raytheon Canada Limited:** Mr. Chairman, I should like to expand slightly on the discussion of the DIP program as an example of an incentive which is subject to a great deal of discretionary power by the government officials working on it compared to tax incentives and others, which are at least in principle automatic. An automatic incentive is one in which the businessman can forecast in advance what benefits he will get, because he sees the percentages in black and white and proceeds accordingly.

In writing a DIP proposal, or trying to engage in one of these dialogues, a great deal depends on what words you put in your application and who reads them. The person who reads the application may not like the words you have used in saying you want to engage in such and such a research. Sometimes it is a matter of how you describe the research you intend to do, or the way you intend to go about it.

At other times, a great deal depends on what you say the market will be. If your project is going to bring in 13 times, the cost, or whatever, you may be asked to prove it and state what the sales will be, which is extremely hard to put down in writing.

So that is a distinction between incentives which are automatic and do not depend upon a bureaucrat's discretion and ones which depend very much on a bureaucrat's discretion.

**Mr. Mundy:** Mr. Chairman, I really feel that these problems we have been discussing will be solved if, in fact, there is this structured and sophisticated interface on a sector-by-sector basis, in which each sector has a chance to tell the government what problems they face and what they need. I think that is the key to it.

**The Chairman:** Probably to complete this, one development might be that we should abolish, perhaps, all these special grants programs and have a single one, which would be adaptable, to fit different circumstances in different industries, rather than having six or seven programs administered by different people with different requirements.

**Mr. Mundy:** That could be it.

**Mr. MacNaughton:** Mr. Chairman, we feel that, taking research as opposed to development, the research programs we have found the most successful have been those administered by active government laboratories, with like interests to those of the companies, so that it is a scientist talking to a scientist. The programs of the Department of Industry, Trade and Commerce are largely aimed at developments and project development, in which the man with whom you deal in the department is an administrator rather than a scientist. So we think there would be great danger in putting it all in one.

**The Chairman:** I was not really thinking about the program which comes under NRC but about all of the other programs which are administered by the Department of Industry, Trade and Commerce. We have five or six now. Perhaps we have one less than that because I hear they are being abandoned, but it seems to me that it might be useful to have one which would be adaptable to various circumstances.

**Mr. Mundy:** We would agree with that, Mr. Chairman, if you really achieved an objective of flexibility.

**The Chairman:** Provided you have your dialogue?

**Mr. Mundy:** Flexibility and adaptability to the circumstances prevailing in an industry, and this could well be an improved program. But you really must have this flexibility in it to suit certain circumstances. You also have to do what representatives from EEMAC were saying: you have to improve the administration of those programs so that the bureaucratic delays are reduced and the bureaucratic demands for information are reduced. So those two things have to be done: you have to reduce the bureaucratic delays in the program and you have to have flexibility. Then a single program might be effective.

**Senator Carter:** Mr. Chairman, I do not see how a single program could be made to work. It would have to be set up under an act. All of our problems that we have with these grants are because they are authorized by legislation. A good many of them are, anyway, and the legislation either specifies conditions or specifies regulations which the department makes and they are made by bureaucrats who really do not understand very often what the purpose of the thing is. I have had numerous instances in recent years of people coming for legitimate grants, but because there has been some little clause in the legislation or in the regulations they have been precluded from receiving the grants. That is where the thing gets fouled up. Unless you have a knowledgeable person with the right attitude who can interpret the spirit of the legislation or regulations rather than simply the letter of it, then I do not really see how you can make it work.

**Senator Yuzyk:** I think you could make it work if you established it on the same basis as the Canada Council, with a peer system. You would have to revamp everything here, but we have an example in Canada Council, and I would point out that most of our witnesses have supported that idea with a peer judgment. I think the flexibility would be obvious if you brought it under one roof, so to say.

**The Chairman:** I am afraid we will have to wait until we get the Sherwood Report. I am told that it might become available. Whether it becomes public through leaks or by being tabled by the minister, I do not know, but we



may want to go back to you when we get that report in order to have your reaction. I am sure you will want to react directly to the minister as well. It seems to me that it will be a very important role that you will have to play at that time.

**Mr. Young:** Mr. Chairman, I should like to make one point. From the dialogue we had with Mr. Sherwood relative to research and development, assuming the report becomes public, on the question of research we had a little dialogue earlier on the fact that you need something like a peer system when scientists from industry talk to scientists from government about what we call our research programs. Mr. Sherwood did not go down in his dialogue with us to that level of support programs. So all of the dialogue that we have had with Mr. Sherwood was really

the ITC type of dialogue on development through to production and to marketing. We had no dialogue at all on what we call pure applied research.

**The Chairman:** Well, if it did not take place before, then, after the report becomes available, it will certainly be important for the dialogue to take place between you and the minister, and possibly you will come back to us and give us your reaction. We can end on the note that we will see each other again, then, and I must say that we appreciate the points you have made during these discussions today and, although we tend to play the devil's advocate, I would not want you to leave with the impression that we do not accept some of the basic points you made this afternoon, and which both of your groups have already made in your respective briefs. Thank you very much.

The committee adjourned.

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APPENDIX "51"

SCIENTIFIC & INDUSTRIAL R&D POLICY

Submission

to the

SENATE COMMITTEE ON SCIENCE POLICY

March 1976

Electronic Industries Association of Canada

77 Metcalfe Street, Suite 809

Ottawa, Ontario K1P 5L6

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## SCIENTIFIC AND INDUSTRIAL R&amp;D POLICY

*General Conclusions and Recommendations*

The Industrial R&D situation has deteriorated significantly since the submission of the Senate Report. The level of industrial R&D procurement and support activity has declined in real terms as a result of the lack of firm government science and industrial policy, the general economic downturn and the influence of inflation. There was an increase of 14% in 1974, which was almost completely offset by the GNP deflator. In 1975 there was no change in current dollars and therefore there was a decline equal to the inflation factor. *The feeling is that direct action to increase industrial R&D is the primary necessity at this phase of Canadian industrial development.*

The industry is concerned that the problems will be defined and "solved" on a philosophical basis; the fear is that the industrial R&D climate will deteriorate further while the government engages in a period of introspection and questioning. *There is need for formulation of beneficial policy and immediate implementation.* A Science Policy is not an end in itself but a means to a social and economic end. Many of the points in dissertations on the subject, including the Senate Reports, deal with the mechanism of administering a Science Policy. Vital aspects of less tractable nature and Industrial Policy or Strategy; National Goals and National Projects; acknowledgement that industry, particularly secondary industry, is vital to Canada's economic and social well being. There is urgency in dealing with policy matters. Departmental structures and organizations can follow more easily thereafter.

The recurrent economic down cycles which have occurred in Canada in the last few decades are particularly evident in the electronics industry. Recently, the government has cancelled the DIR and IRDIA programs and announced reductions in other support programs. *The loss and reduction of these programs is extremely significant in indicating the tenor of government policy besides directly affecting the earlier stages of industrial R&D.* It is characteristic of the Government departments to cut extramural spending when called upon to exercise austerity measures. *The industry looks with favour on the use of tax incentives as a major technique of research and development expansion.*

The adverse aspect of the present climate for science and secondary industry is the growth of the service areas of our economy without the corresponding strengthening of the wealth-producing secondary industry. Thus it is once again popular to propose a policy whereby our natural resources (many of which are non-renewable) are to be exported and our internal economy will be dominated by service industries. Obviously, all Canadians are interested in achieving social and economic betterment, but it is a fact that most social and economic advances are implemented through higher technology industry. Thus, *it is with extreme concern that this committee notes the reluctance of the Canadian Government to acknowledge the role and significance of secondary industry in general and that of the Electronics industry in particular.* The lack of a statement of a role in Government Policy for this strategic industry—a statement which in itself would be a minimal commitment and would only parallel the action of most industrially advanced countries—is indicative of the problem to be overcome in developing a Canadian Science Policy.

*The major positive move taken by the Canadian Government has been the Make or Buy Policy and its complementary structures.* There is little doubt that a strongly implement-

ed policy of make or buy could produce substantial realignment of the performing sectors. However, it is also true that pressure on government departments to implement make or buy has produced many "buy" decisions where the items or material traditionally would have been bought in any case. Further distortions of the make or buy data have been introduced by "body shopping", i.e. "consultants" working directly under government employees usually at negotiated rates. Under these "industrial contracts" the consultants are government employees—in all but name and security. The benefits to industry are minimal. *Perhaps the brightest spot in the Make or Buy Policy has been that of "Unsolicited Proposals" and "Bridge" Funding.* This has introduced to industry the opportunity to bypass the long Government budgetary cycle which has inhibited funding of many good ideas for R&D programs.

*Specific Comments on Senate Recommendations*

The attached comments concerning specific excerpts from Volumes 2 and 3 are worthy of highlighting because they are at variance in part or in emphatic agreement with the Senate Committee recommendations. Reference numbers are those of the recommendations of the Senate Reports.

## VOLUME 2—TARGETS AND STRATEGIES FOR THE SEVENTIES

*Chapter 13—Broad Framework and Target for Science Policy for the Senate*

- 1,2 We doubt the value of extensive Future's research in the development of National Policy given the present trend towards philosophizing rather than acting. The Science Council, not the Economic Council, should set up the Committee on the Future if such a committee is required. The scientific industrial viewpoint must be well represented.
3. There is a need for the Canadian government and Parliament to adopt an overall plan for the Seventies and Eighties for Science and Technology.
4. A national R&D inventory should include industrial activities to the extent possible.

*Chapter 14—Targets and Strategies for Basic Research*

- 6,7 There is no need for another Board or Council and its three foundations instructed to develop a capacity for curiosity-oriented research, particularly where an overall organizational policy is lacking.
- 9,10 It is recommended that Canada concentrate on specific classes of basic research, i.e. 1) Internationally recognized areas of Canadian excellence and 2) Basic research identifiable with major Canadian Scientific developments and objectives, rather than set a rather arbitrary percentage as a target. We agree that the emphasis should be on quality rather than quantity.
15. The guidelines in selection of projects were agreeable with a strong caveat that political-geographical pertinence may be strongly in favour of Canada's individual pursuit of certain otherwise undesirable programs.
19. The recommendation that the institutes perform a substantial portion of their work at the request of government agencies and private firms on a fee basis is incompatible with a curiosity—orientation and motivation.



*Chapter 15—Industrial Innovation and the Canadian Government's Impact*

20. It is suggested that the target of R&D activities to be performed by the industrial sector by 1985 should be bolder—perhaps 75-80% by having industry do more than Government labs do at present. This is considered to be a more economical catalytic mix.
- 21-25 The recommendations oriented towards Industrial Reorganization produced a wide range of adverse comments from the EIAC members. The reactions ranged from unattainable to comments that the government had demonstrated actions resulting in less, rather than in more, rationalization of industry. In general, industry responds best to financial forces. The goals should be attainable and profitable.
- 27-30 The recommendations regarding liaison and training were considered peripheral to a government-industry strategy, however it was considered these are unresolvable opinion matters and likely to lead to unproductive debates with heavy civil service participation.

*Chapter 17—Industrial Innovation and Direct Government Assistance*

34. There was agreement regarding the need for consolidation of grants encouraging R&D activities in industry, although it was pointed out that there are now fewer programs than at the time of the Senate recommendations, and government data show a net decline in dollars of grant plus contract funds from the Federal Government.
35. The proposal for an Innovation Bank was considered as impractical where required as a mix with private venture capital. There is also the continuing hazard here that interesting problems will be studied for very limited application with consequent inefficient use of technological resources.

38. The consolidation of "latter government laboratories" in a new Crown Company might achieve the benefit of eliminating the tendency to proliferate investigatory groups in various government departments operating on a 'no cost' basis. The concept of "growing industry contribution to its financing" where the company is responsible to the Department of Industry, Trade and Commerce is considered inappropriate and impractical.
39. The recommendation for imposition of an immediate financial and manpower limit was considered laudable and still valid for 1976. There also should be stern restraints on unchecked extension or sophistication of scope.
43. The development of a Canadian information and forecasting industry as stated is considered inappropriate.
44. The accurate forecast of manpower requirements is an idealistic objective. It is not likely, in this real transitory world, that analysis and directed graduate studies will lead to a better mix than the present individual, somewhat randomized choice.
45. The recommendations regarding mobility are considered to be directly relevant to the problem of transfer of R&D work from government to industry. There is a very serious imbalance of transfer pressure now as a result of the employment benefits of government positions relative to those in industry, i.e. higher pay, more fringe benefits, less demanding working conditions and greater job security.

VOLUME 3—A GOVERNMENT ORGANIZATION FOR THE SEVENTIES

Volume 3 produced only a few comments—almost all favourable. There was emphatic endorsement of recommendations 14 and 15 with the suggestion that participants other than the Senate be involved in the science budget reviews. It was proposed that recommendations developed should be delegated to a parliamentary committee for action.

## APPENDIX "52"

## AIR INDUSTRIES ASSOCIATION OF CANADA

RM 601 ROYAL TRUST BLDG 115 ALBERT ST. OTTAWA 4 ONTARIO 232  
4227

December 9, 1975

Senator M. Lamontagne  
Chairman  
Special Committee of the Senate on Science Policy  
The Senate  
OTTAWA, Ontario

Dear Senator Lamontagne:

In response to your recent letter request relative to the forthcoming activities planned by the Canadian Senate Special Committee on Science Policy, the Air Industries Association of Canada (AIAC) is pleased to respond. AIAC represents some one hundred (100) companies involved in the advanced technology fields of aircraft, engines, space, and related equipment/systems activities. It is not our intention to submit a formal brief, but we do welcome the opportunity to provide this written representation.

Your "watch-dog role" in area No. 1—futures research programs—we recognize as a commendable goal. We note in the report, "A Science Policy for Canada, Volume 2, Targets and Strategies for the 'Seventies", on page 424 the following:

"In summary, the Committee proposes an increase in the magnitude of the overall Canadian R&D effort to place it more in line with those of similar countries. This change should be accompanied by improvements in the redistribution of the R&D effort toward the development end, from performance by government to performance by industry, and this can only be accomplished by instituting an effective framework of decision-making. With a Commission on the Future to assist in the development of an "anticipatory democracy"; a national network of information on science and technology, including a technological forecasting service; and medium-term plans for R&D activities, Canadian science policy would gain the broad perspective and dimension that it needs to make its full contribution to national goals."

These goals represent commendable governmental and industrial policy. The "effective framework of decision-making" requires leadership with decision-making authority/responsibility and not necessarily delegated to a centralized forum, institute, or "royal commission" approach. We would prefer that your Committee both undertake the survey of futures research programs and retain the responsibility for the "watch-dog role", if at all possible.

On your "watch-dog role" in area No. 2—review of the implementation of the recommendations of Senate Science Policy Committee—we wish to specifically comment on three recommendations in Volume 2: Items Nos. 5, 20, and 34. We have no comment at the present time on your recommendations in the report, "A Science Policy for Canada, Volume 3, A Government Organization for the 'Seventies", in view of the mixed performances of various government departments/ministries.

P421 "5 ... national expenditure on R&D should reach 2.5 per cent of GNP by 1980, it being understood that the Canadian government's direct contribution to reaching this target will be restricted to the support of worthwhile programs and projects."

The Association can firmly state that the 1970 R&D per cent on GNP (about 1.25%) should approach 1.87% in 1975 if your target, per the foregoing recommendation, is to be met in 1980; the Association has no indications that an upward trend on national R&D expenditures has occurred over the past five (5) years; indeed (within our industrial sector), the indications are quite the reverse.

P499 "20 ... the R&D activities performed by the industrial sector be substantially increased so that by 1980 they represent a maximum of about 60 per cent of the national R&D effort."

This significant recommendation by your Committee is of substantial interest within our industrial sector, and indeed represents a fundamental goal of the Cabinet in formulating the "Make Or Buy" policy. However, in the past five years little change has occurred, and the current industrial R&D effort constitutes about one-third of the national R&D effort.

P578 "34 ... all existing specific grants designed to encourage R&D activities in industry be integrated into one multi-purpose program, and be administered by the Department of Industry, Trade and Commerce in the light of the broad guidelines proposed for the determination and management of these subsidies."

In recent years, the administration of programs relative to R&D activities in the aerospace industry has been completely unsatisfactory. Lack of industrial experience, knowledge, and appreciation of commercial business by the government personnel dealing with the aerospace sector has failed to produce the required results. It is our considered view that *research* support programs demand quite different criteria, technical evaluation and monitoring, and potential benefits assessment from *development* support programs. Administration within one government department of both research and development support programs is feasible, but inherently more difficult to operate.

Regarding your "watch-dog role" in area No. 3—MOSST role—the Association understands that, with the recent changes within MOSST, quantitative assessments will be forthcoming on "Make Or Buy" activities and on government support programs in general.

With relevance to two specific matters, the Association wishes to comment upon "Make Or Buy" activities, and the Defence Industrial Research (DIR) Program administered by the Department of National Defence. The "Make Or Buy" activities administered by the Department of Supply & Services is excellent in concept, and with the introduction of a mechanism for handling unsolicited proposals from industry and the provision "bridge" financing, the program has improved.

However, members of this Association have by and large found it difficult to take advantage of the program, in that our research is mainly product oriented.

The administration of the appropriate DSS Science Procurement Sector "Make Or Buy" group, and their response to industry involvement, has been excellent. Through no fault of their own responsibilities, however, actual dollar increases to secondary industry companies through the "Buy" mechanism demands substantial improvement to achieve 60% of the national R&D effort in the industrial sector by 1980.

On the second matter, the DIR Program was effectively cancelled on January 2, 1975, and was a shock to members of this Association. DIR Program research support has made a substantial impact on, and resulted in benefits to, the *product lines* of our companies. Over the years, the contribution of DIR Program support towards research in our industry has been outstanding, but notwithstanding representations by affected industry members and by this Association to government, little progress towards continuation of research affected by funding support withdrawal has been achieved to date.

In summary, the following words by yourself in the Senate debates of July 10, 1975 reflect viewpoints supported by this Association; namely,

"... the make-or-buy policy which we recommended to help industry carry out more research and development activities on a contractual basis has been accepted by the government but there is a general impression that departments and agencies should buy much more than they do

and, in the process, further strengthen the innovative capacity of private industry. We believe that the zeal for desirable reforms created by our report two or three years ago has diminished and that the proposed review might prevent the return of the former status quo."

Recently generated government policies relating to science and technology have objectives to improve the capabilities of Canadian industry. These policies, however, have been developed with little meaningful consultation with our industry, and the actual implementation of the few policies with potential industrial benefits have not been firmly acted upon by the responsible ministries.

We would welcome the opportunity of meeting with your Committee to elaborate further on our views, if you should so wish.

Yours sincerely,

D. B. Mundy  
President



Government  
Publication

First Session—Thirtieth Parliament

1975-76

# THE SENATE OF CANADA

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SPECIAL COMMITTEE OF THE SENATE ON

## SCIENCE POLICY

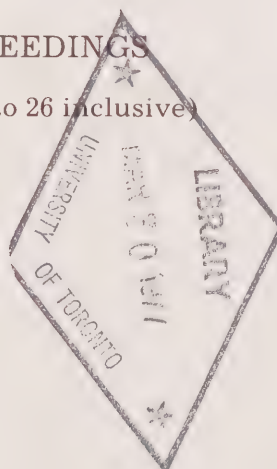
The Honourable MAURICE LAMONTAGNE, P.C., *Chairman*

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OF PROCEEDINGS

(Issues Nos. 1 to 26 inclusive)





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by the  
Reference Branch,  
LIBRARY OF PARLIAMENT.

# THE SENATE OF CANADA

Special Committee on Science Policy  
1st Session, 30th Parliament, 1975-1976

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